

THE CONDUCT OF  
BUILDING WORK,  
AND THE  
DUTIES OF A CLERK OF WORKS.

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J. LEANING.

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Ernest D. Wooten  
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1907.

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THE  
CONDUCT OF BUILDING WORK

AND THE  
DUTIES OF A CLERK OF WORKS

A GUIDE TO  
THE SUPERINTENDENCE OF BUILDING OPERATIONS

BY  
J. LEANING, F.S.I.

AUTHOR OF "QUANTITY SURVEYING,"  
"BUILDING SPECIFICATIONS," ETC.

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REVISED AND ENLARGED.*

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## PREFACE TO THE SECOND EDITION.

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IN the process of revision it has seemed reasonable to add a number of small items which did not appear in the First Edition.

The Instructions to Clerks of Works by the School Board for London, the synopsis of regulations adopted by various other public bodies, and the rules for Examination of the Incorporated Clerk of Works Association of Great Britain will probably prove useful.

JOHN LEANING.

*October, 1904.*

# PRELIMINARY TO THE SECOND EDITION.

The second edition of this work is now in the hands of the printer, and will be ready for sale in a few days. It contains many additions and corrections, and is in every respect a new work.

The first edition of this work was published in 1841, and has since that time been the property of the author. It has been the subject of many inquiries, and has been the means of doing much good. The second edition is now published, and will be the means of doing much more good.

JOHN W. LARSEN.



## PREFACE TO THE FIRST EDITION.

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THE supervision and conduct of building work, whether by an Architect or a Clerk of Works, are so similar that it appears reasonable to extend what was first written and published under the title of "The Duties of a Clerk of Works" by the addition of some suggestions which may contribute to the production of good buildings, and perhaps assist both.

The qualifications of the Clerk of Works are a matter of grave importance, but his appointment very often does not depend upon his fitness for his work; successful concealment of his ignorance, a pleasing manner, misguided good nature on the part of a former employer, and various occult influences which need not be mentioned, are among the unsatisfactory elements in the appointment of a Clerk of Works.

Although all systems of examination have been fiercely attacked at various times and in various connections, their extension to almost all positions of trust is a strong argument for their adoption in the case of the Clerk of Works.

There is very little doubt that the Clerk of Works Association should be an examining body, but the repugnance of the majority of its members to that course gives little hope that it ever will be.\* That its importance as a corporation would be greatly increased thereby does not admit of doubt; moreover, the status of a successful candidate would be raised, and his salary correspondingly increased.

The Government departments insist upon examination for the appointments at their disposal, and if the Royal Institute of British Architects could be induced to establish an examination on similar lines, their certificate would be an assurance of attainments which many Clerks of Works do not at present possess.

The latest published examination papers for the position of Clerk of Works in Government departments are appended, and may assist Architects to conclusions as to what they ought to expect from a Clerk of Works worthy of the name; they may also be useful to those who propose to qualify for such appointments.

J. LEANING.

*September, 1898.*

\* The Clerk of Works Association has now adopted a modified system of examination. See Appendix.

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THE  
CONDUCT OF BUILDING WORK  
AND THE  
DUTIES OF A CLERK OF WORKS.

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PRELIMINARY ARRANGEMENTS FOR A PROPOSED  
BUILDING.

**Site.**—When the site of the proposed building is vacant ground, enquiry should be made for any plan which may exist, and this should be taken to the site and carefully checked by measurements; it should be thoroughly tested, and all the boundaries measured and figured. If surrounded by buildings, it should be observed whether these are lighted from the site in question, in which case the legal obligations as to light and air must be remembered. If the site is on the opposite side of a street to buildings which have been built sufficiently long to acquire rights of light and air, care must be taken to avoid their infringement.

## 2 THE CONDUCT OF BUILDING WORK AND

If the site is occupied by a building which is to be demolished, it is important, especially in a narrow street, for an elevation of the old building to be prepared to scale with all the openings as evidence in case of future dispute.

**Pulling Down.**—If an old building occupies the site, and it is sold to a housebreaker to pull down, a stipulation should be made for efficient shoring, to the satisfaction of the Architect and the local authorities, for the clearing away of the whole of the rubbish, including any that may fall into the basement, if there is one, also for the pulling down of the basement walls, and the strutting and planking of the surrounding earth. This may be ensured by the deposit of a sum of money to be forfeited in case of neglect of the stipulations. In most cases it will be advisable to dig trial holes in various parts of the site to ascertain exactly the depth desirable for the foundations.

The housebreaker generally erects the hoarding, also shoring and struts, and planks.

If the proposed building is of the kind which has to be approved by the District Surveyor, the Ecclesiastical Commissioners, the Local Government Board, or the Education Department, the

drawings should be submitted to such authority before the quantities are prepared or tenders obtained. It will often be practicable to obtain an unofficial approval when they are drawn in pencil only; sometimes this submission is delayed until the drawings are completely finished and the quantities prepared, and considerable expense is afterwards incurred by enforced alterations. As a rule an ordinary architect's estimate is sufficient at this stage.

It is always an advantage to the Architect to obtain a copy of the local by-laws, and so see to what legal regulations he must conform.

In the case of a proposed building on the site of an old one it will usually be necessary to prepare the drawings for the new building before the demolition of the old. This is a fruitful source of error, and should therefore be carefully done. It is often found when the site is cleared that the plan is incorrect, especially if the site is surrounded by buildings.

Whether the building is completely new or an addition drawings of the old building should be made, and when between other buildings drawings of the party-walls.

**Trial Holes.**—When the ground has not

previously been built on trial holes should be dug. The nature of the soil, the depth of each hole, and its position noted on the site plan.

**Levels.**—If the ground is not level, levels should be taken and plotted on the block plan. It is usually convenient to refer this system of levels to the nearest Ordnance Bench mark.

**Bearing Power of Soil.**—In the case of very high and heavy buildings it may be necessary to test the bearing power of the soil.

**Drawings.**—The drawings, details, and specification should be completely finished before they are put into the hands of the Quantity Surveyor; this course being always an ultimate saving of time and a protection from extras.

The drawings should be carefully figured, and carcase measurements are preferable. The principal dimensions on the plans should be confined to the ground plan; if any are repeated on the plans of the other floors, observe that they agree. The dimensions on the sections should give measurements from the top of the joists of one floor to the top of the joists of another. These floor levels should be indicated on the elevations by coloured lines. Those parts of the brickwork which it is intended to



build in cement should be coloured with a special tint or etched on the plan. Each of the various kinds of floors should be coloured with a specific tint. The bedrooms should be numbered consecutively, and two series in one building avoided. The drawings, as far as possible, should be to a uniform scale, and the elevations designated by the points of the compass.

**Systems of Contract.**—These may be arranged in various ways. A contract on quantities, a contract without quantities (on drawings and specifications), on a schedule of prices, or purchase by the building owner of materials, and employment of workmen by him directly under the supervision of a Clerk of Works.

The first three of the foregoing methods may either be a contract with a sole contractor or with a separate tradesman for each trade.

It is argued by those architects who make contracts with separate tradesmen that the work is done more cheaply than by a sole contractor, but the division of responsibility, the greater labour and trouble in the supervision, and the frequently incompetent management of the small men go far to counterbalance the lower price when it exists, which is often not the case.

Work on schedule of prices is never done so cheaply as by ordinary contract for a total sum. It is, however, useful for such works as the building of the lower part of a building, as the foundations, or the carcase up to the ground floor, when there has not been time for the completion of the drawings. The superstructure above that level may then be contracted for in the ordinary way.

The purchase of materials and the employment of men direct by the building owner is invariably the most expensive method of building.

It will be necessary before inviting tenders to decide whether it shall be open to all who desire to tender, usually discovered by advertisement, or limited by invitation to a certain number of selected builders. Sometimes an advertisement asks for names of men willing to tender, and a selection is made of those most desirable. A judicious selection will comprise men of a similar class, and with a reputation for doing such work as is desired.

It is not fair or expedient to invite a great number of builders to tender; six or eight tenders as a rule give as fair a result as a much larger number.

Some Architects adopt the following clause in their conditions of contract: "All drawings, tracings, or models used in the production of the building to be returned to the Architect without any copies being kept."

**Quantity Surveyor.**—In cases where the Architect and the Quantity Surveyor are thoroughly conversant with each other's work, the drawings may be given to the latter in pencil, together with a series of mere notes of the specification. The Quantity Surveyor will then write the specification from the dimensions, and the Architect will finish his drawings, and perhaps modify them in certain respects at the Surveyor's suggestion, as the careful analysis requisite to produce the quantities will sometimes discover weak points of construction or arrangement. In all other cases the complete drawings, specification and details should be deposited with the Surveyor.

In addition to the work of preparation of the quantities, the services of the Quantity Surveyor are often adopted for the writing of the specification, the surveying and levelling of the site, the production of plans of existing buildings, and for reporting the value of the work for

certificates. When the Quantity Surveyor has been informed that this last item of work will be required of him, he is able to arrange his notes in such a way as to facilitate this purpose, *e.g.*, by abstracting the dimensions in sections, such as all the work up to ground floor level, between ground and first floor level, &c.

If the Architect intends to employ for the adjustment of the variations the Surveyor who prepared the quantities—and this course has its advantages—he should, after examining them, send on the day accounts to the Quantity Surveyor, who can then deal with any question connected with them as it arises.

The supplying of the Surveyor with the details of stonework is specially important; he can then, as he takes off the work, figure on the details the beds of the stones as taken, which course obviates the necessity of specifying the bed of every stone. Extras are effectually avoided by preparing the quantities from the details, and the preparation of the latter simultaneously with the general drawings ensures a precision in the whole which many sets of drawings do not display.

**Foreman.**—The relations of the Architect

with the Builder's Foreman are important. It needs no argument to show that there should be a Foreman constantly on the works; some builders in the case of small works endeavour to do without one, but this should never be permitted. In cases where he renders himself obnoxious, either from incompetence or incivility, most contracts afford sufficient power for his removal, and this power may be exercised early in the progress of the building, but when it is far advanced the discharge of the Foreman often causes great inconvenience. It should not be forgotten that incivility is very often an expression of contempt for the ignorance of the Architect, and the obvious moral is "not to be ignorant."

The insistence by the Architect on the discharge of a workman is rarely necessary if the Architect refrains from finding fault directly with the men. He should complain to the Clerk of Works or to the Foreman.

**Materials.**—Enquiry in the neighbourhood of the site of a proposed building will show the local materials available. For want of this precaution stone, bricks, tiles, &c., are often specified to be brought a long distance when material of quite as good quality are obtainable close at hand.

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**Clerk of Works.**—The various views which are entertained as to the duties of a Clerk of Works may excuse a short statement of the more important considerations relating to his functions and obligations.

As in all other classes, the thoroughly capable man is the exception ; conspicuous ability is not to be generally expected, but a combination of assiduous attention to duty, integrity, and a fair knowledge of building is not rare, and these qualities are usually sufficient for the creditable performance of the duties of a Clerk of Works.

To their Clerks of Works Architects are often much indebted, and many magnificent buildings, which are monuments of good material and workmanship, attest their ability and attention to work.

The result of labour, for the most part so successful, forces upon us the conclusion that if the comparatively untrained man does his work so well, the properly trained and educated Clerk of Works should be worth much trouble to produce, and would amply repay the care and pains bestowed upon his training.

It is generally admitted that the best Clerk of Works has worked at, and thoroughly learned one of the building trades ; in many



cases he has afterwards worked as a Builder's Foreman, and this latter part of his training has probably given him a knowledge of men and of their management, and a broad view of building operations which the mere working at one trade could not possibly afford. If his experience as a foreman has been extensive he will also be aware of the tricks resorted to by builders and builders' men to save materials and labour, and will derive advantage in his vocation from that knowledge.

Beyond these accomplishments, however, there are others hereafter referred to with which he cannot well dispense.

The quondam Architect's Assistant often makes a good Clerk of Works, his knowledge of drawing and detail being very useful to him, but on the other hand he is usually deficient in that practical knowledge of building which is so important.

One of the disadvantages of the employment of this type of Clerk of Works is his possible interference with detail, of which sometimes he knows more than his employer, the Architect, and he is consequently tempted to deal with matters which are not in his province.

Of the mere pretender we will say but little. If he is astute he is not often found out until he has done much injury, and this consideration should impress the Architect with a consciousness of the importance of his selection.

Napoleon's question, "What has he done?" will be a cogent one for the Architect to ask before he engages a Clerk of Works, and his safest plan will usually be to engage none but those who have creditably superintended a building in that capacity.

The Clerks of Works Association keeps a register of members desirous of engagement, which is sometimes useful.

The character of the building should regulate the selection of the Clerk of Works. If the most important part of the work is masonry he should be a mason, if joinery a joiner, if brickwork a bricklayer. Probably a mason would best supervise a large work of terra-cotta.

A building may be so small that the employment of a Clerk of Works for that exclusively would be unreasonable, but an Architect with several works of moderate size in progress within easy distance of each other may still employ a Clerk of Works with advantage,

putting him in charge of the several buildings and apportioning the expense.

The ideal Clerk of Works—

Is honest.

Is temperate.

Knows one building trade practically and thoroughly.

Can make working drawings for any trade.

Knows the general practice of measuring artificer's work.

Can make a simple land survey.

Can use a dumpy level.

Can set out a building.

Knows the value of the leading items of each trade.

The Clerk of Works should be at the building from 9 a.m. until the men cease work, and if he has reason to suspect trickery should occasionally go to the works in the morning at the same time as the men. Omissions of concrete, filling up large piers with rubbish, building in bats, and other vagaries often occur in the early morning, "the sweet hour of prime." However, a man who understands his business knows what to look for, is not to be deceived by the work of two or three hours,

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and if he suspects deception can soon solve his doubts.

The important element of time and its great pecuniary value sometimes necessitates the working of men day and night, and this will involve the employment of a day and night shift—that is, a gang of men for day and night respectively, and consequently two Foremen and two Clerks of Works.

In the case of two Foremen and two Clerks of Works, one of each two should be subordinate to the other. Both Foremen and Clerks of Works should be changed from the night to the day shift once in every three or four weeks, and each Foreman should be associated with the same Clerk of Works throughout the work.

The night Clerk of Works and the night Foreman should be at the works at least an hour before the departure of the day Clerk of Works and the day Foreman, so that instructions may be taken and the continuity of the work maintained.

The Clerk of Works should take objection to any man who may be permitted to work beyond the usual hours of his shift, and, as night work is never so successful as day work, may in

certain cases find it advantageous to postpone portions of the work till daylight.

If the work is executed by contract its management makes little pecuniary difference to the building owner. If "day work" the Clerk of Works must take care that one shift does not interrupt the work of the other by any interference with it; all work should, if possible, remain in the same state in which it was left until the return of the same shift to the building.

In contracts where night labour is anticipated an arrangement is usually made for the price of labour during the night. If not, special care should be taken to observe the time charged and its rate. The charges for overtime recognized by the local trades union would probably apply, and the decision as to whether certain "day" works should be done during daylight or not may seriously affect their cost.

Occasionally the Clerk of Works is employed in a different capacity to the usual one: he is placed over a system of works, purchasing the materials and employing and paying the workmen, a position full of temptation, exposed to much suspicion, and possibly to scandalous

imputation. The Clerk of Works in this position should insist upon being treated by the persons who supply building materials as though he were a builder, and should obtain for the building owner all the trade discounts, preferably paying the accounts by certificates direct upon the building owner and steadily refusing any sort of gift or personal favour (for it will certainly be offered) from any one with whom he has any monetary dealings.

A very large building will require several Clerks of Works, but one of them should be chief, and to him all the rest should be responsible.

The generally received relations of the Clerk of Works to the Architect and building owner are defined by Mr. Hudson in his "Building Contracts" as follows:—

"The Clerks of Works are persons appointed or employed by the Architect or Employer to watch and superintend on behalf of the Architect and Employer the progress of the works, and to point out to the Contractor such work and materials which he or they think are not in accordance with the contract (without thereby creating any undertaking on the part of the employer that they shall do so) and to order



such work and materials to be pulled down, removed, or broken up, and to mark or identify such work and materials, and to report thereon to the Architect or Employer, but none of the said persons shall have any authority whatever to bind the Architect or the Employers by any approval or passing of work or materials, or to take any responsibility of setting out or making details, or to commit the Architect or Employers by any act or omission, or order or direction, or to order any work involving delay or extra cost. The work and materials shall not be approved by any other person than the Architect, and nothing herein contained shall prejudice the right of the Architect to condemn, reject, or disapprove of work and material at any time, whether such Clerks of Works shall have inspected such work and materials or failed or omitted to inspect or point out such work and materials or not."

The limitation of the authority of the Clerk of Works is important, as the Architect must still retain all his judicial functions; with this view various clauses have been used in specifications, such as the following:—

"The Clerk of Works shall be considered to

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act solely as inspector, and under the Architect, and the Contractor shall afford him every facility for examining the works and materials”;

Or, “The Clerk of Works is in the absence of the Architect to be considered his deputy, and the reasonable directions of the Clerk of Works are to be attended to by the Contractors, subject to appeal to the Architect, and the Contractors shall afford the Clerk of Works every reasonable facility for examining the works and materials. The Clerk of Works shall have no power to direct any variations in the contract or to give orders for any extra works.”

The signature of the Clerk of Works on day sheets is usually adopted as a warrant of correctness, but some Architects use a condition like the following:—

“In the case of variations, where day sheets are rendered by the Contractor and signed by the Clerk of Works, it shall be within the discretion of the Architect to decide whether these works should be allowed as day work or measured and valued at the rates in the priced bill of quantities deposited by the Contractor.”

It is best to settle in writing at the time of

his engagement all the permanent arrangements with a Clerk of Works, such as what time shall be spent daily on the works; if in the country how often fares will be paid to and fro, and by what class; the amount of salary, and the period of notice on either side.

If the work is in the country the Building Owner should pay one third-class fare each way between the place of engagement and the building.

The salary of the Clerk of Works should be sufficient to protect him from the temptation of bribery.

The Architect, more often than not, expects to obtain the services of a Clerk of Works endowed with all the Christian virtues, and familiar with every detail of the building trade, assiduous in his business, and incorruptible, for about three pounds per week. Sometimes he is disappointed.

It is usual for the Building Owner to pay the salary of the Clerk of Works, but all his instructions should come from the Architect. So far as possible the authority of the Clerk of Works should be encouraged, and it should not be interfered with except for strong reasons,

and, as a rule, the directions to the Contractor should be given by him.

Discourage as far as possible direct interferences by the Building Owner with the Contractor or his men. In the event of a dispute the Contractor will make valuable legal capital of such interferences.

The Architect should supply tracings, general drawings, and details. Some Architects require a Clerk of Works to make tracings for the Builder; as a rule his time is better spent on supervision.

The Architect should supply stationery, a diary, a measuring-tape, a pair of 5-foot rods, and, where the building is large, a level; 10-foot rods are usually made on the works.

The Clerk of Works should be furnished with a copy of the specification, including the conditions of contract, and with a set of the quantities; it is better that no prices should be attached to this copy unless the weekly report demands an estimate of the work done, in which case the prices are necessary, and greatly facilitate the making of an approximate estimate. The Clerk of Works should treat this as a confidential document, and should allow no one to have access to it.

Under the London system of contracting, which involves three documents, drawings, specification, and quantities, the Clerk of Works may dispense with the quantities, but in the north of England, in Edinburgh and Glasgow, the practice being to combine quantities and specification, the bill of quantities is indispensable, as it not only states the quantities, but the position of the items in the building. Moreover, as a general rule, under this arrangement the quantities are a part of the contract, *i.e.*, every item is open to correction, and the Clerk of Works must make notes with that view.

Under this system the work is contracted for by men in the several trades, and this involves more troublesome supervision, a natural consequence of divided responsibility.

If the Clerk of Works expects an appointment in the north, he should make himself familiar with the local technical terms.

If the employment of a Clerk of Works on a building is intended, the fact should always be mentioned in the specification.

An office should be specified for him in some such terms as follows:—

“Supply an office, not less than 10 feet

square, for the Clerk of Works, with drawing board and two drawers, lavatory, store, and fireplace, all to the Architect's satisfaction, and supply the requisite firing, lighting, and attendance."

**Removal of Clerk of Works.**—The removal of the original Clerk of Works should if possible be avoided. There are many advantages in the retention of the Clerk of Works from the beginning of the work to its close. When there have been many variations it will often be advisable to keep the Clerk of Works on the building during their measurement.

**Work of Specialists.**—Particular parts of a contract are sometimes entrusted to a specialist, as electric bells, electric lighting, drains, plumbing and sanitary apparatus, ventilation, heating, extensive cooking apparatus, decoration, structural ironwork, &c. If this course is adopted because the Architect is not familiar with the requirements of the building in question, he will give general directions to the tradesmen he may select, and the specialist will submit a scheme for approval. The Architect should have the work which is contemplated clearly and fully specified by the specialist, and



where drawings are necessary to make the intention clear, he should have drawings. As the preparation of these particulars is expensive, they will, of course, have to be paid for by an enhanced price for the work, and as a consequence work done under these circumstances always costs much more than if put into a Builder's contract in the ordinary way.

When the Architect knows exactly what he wants, he can write a specification and make drawings of the work; they can then be submitted to several people who do work of the kind, a competitive price obtained, and the amount included as a provision in the contract.

Another course is to have the quantities prepared in the usual way, but as a separate section, although included in the general bill of quantities, giving in the preamble to each section the names of several firms whose work will be accepted, in some such form as follows:

“All the cast and wrought iron and steel work is to be of the very best quality, and to be obtained from one of the following firms: Messrs. Matthew Shaw & Co., R. Morland & Sons, Drew Bear Perks & Co., Dorman & Long.

“The artificial stone work to be executed by Messrs. Wilkinson & Co., the Victoria Stone Co., or the Patent Paving Construction Co.”

If the Quantity Surveyor is instructed to keep all the accessories, such as templates, cutting holes, &c., connected with the work of a particular specialist, in a separate section of the bill, it will be advantageous to all parties concerned.

**Abandonment by, or Ejection of the Contractor.**—In the case of abandonment of the work by the Contractor or his ejection, the works must be stopped, the whole of the work which has been done measured and valued, or the work undone measured and valued, and the amount deducted from the contract amount, when the same result will be arrived at as by the former process. In this operation the Clerk of Works can render material information and assistance, and if the defaulting Contractor will allow his foreman to attend throughout the measurement, his services will usually be worth paying for if not otherwise obtainable. There is usually a clause in the conditions empowering the Building Owner to retain all the scaffolding and materials on the ground. An account of

these should be made before the new Contractor is installed, as they will have to be accounted for at completion.

When works are stopped see that everything is properly protected from damage by weather or other causes.

**Arbitration.**—The adoption or drawing up of an arbitration clause requires unusual care. It should defer all reference until the completion of the works, and this the new conditions issued by the Royal Institute of British Architects provide for, although they do not preclude arbitration on small questions by mutual agreement as the work proceeds. *Lloyd Bros. v. Milward* ("Hudson's Building Contracts," vol. 2, p. 454) shows how the authority of the Architect may be superseded. See also p. 214 Leaning's "Building Specifications."

**Specification.**—Care in the writing of the specification and selection of conditions is always amply repaid.

**Settlement of Accounts.**—If the Architect deposes this work, as he generally does, he should furnish the Measuring Surveyor with a list of the items of variation, and if he has stipulated by his conditions that a written

order should be necessary to the establishment of a claim, he should also furnish copies of the orders. He should also furnish copies of the agreed amounts, and make clear what each item comprises.

The Contractor should also be requested to furnish a list of items which he considers to be variations on the contract.

#### DIRECTIONS FOR THE CLERK OF WORKS.

**Drawings and Specification.**—If the specification, conditions, and drawings are as comprehensive as they should be, the Clerk of Works will experience but little difficulty in the management of his work. Where they are bad he must “evolve” from his “inner consciousness” much which should have been provided for him.

If no office has been provided, the Clerk of Works should keep accurate account of the time and materials expended on its erection. Some Contractors have small movable wooden offices for the purpose, which they move from place to place as required, and for which a rental is charged.

The Clerk of Works should also take notes of the attendance and fuel supplied for his use.

He should be careful to date every paper which he produces, and every measurement which he takes.

He should be provided with a book in which he should keep account of all labour and materials expended upon works for which a sum is provided, as the fixing of lead lights, stable fittings, gas fittings, attendance on separate contractors, or anything which will form the substance of a day account.

In the same book he should note facts about work concealed (with figured sketches, if necessary, to explain the notes), as varied depths of foundations or concrete, beds of stones, or sizes of timbers, if varied, and indeed any information upon which questions may arise in the adjustment of variations. Measurements of hidden work should be taken with the Contractor's foreman, who should have a copy of the measurement. Work which is varied but exposed may be left to be measured at the time of adjusting the accounts.

Sometimes a part only of a particular item of contract work—a porch, for instance—is built,

pulled down, and something entirely different substituted. The Clerk of Works should give notice to the Architect or Quantity Surveyor to measure it before it is pulled down, or do it himself; allow the time spent in pulling down, and claim credit for the materials that are usable. The Surveyor in his final measurement will omit the whole porch as contract, and measure the complete work last substituted for it.

The Clerk of Works should also keep a diary, in which he should enter daily the state of the weather, the number of men at work, the work on which they are employed, the times of cessation of work from any cause, how long it lasts and the cause of stoppage, the name and business of any person who visits him, including the Architect or his clerks or the Building Owner, and the quality of materials delivered and their rejection. He should also note in this diary every document he receives, and put a note of the date of receipt on such document.

The Clerk of Works should not suggest extras, but should leave the Builder to make his own claims.

See the receipts for the fire insurance at the



times when the premiums are paid, and take care that the policy is renewed in time.

If any work is shown or described in a manner strikingly different from common usage, the Clerk of Works should enquire of the Architect if such is his intention. Work or methods of execution which involve a greater expenditure of labour or material (or both) than is covered by the specification and drawings should not be ordered without the authority of the Architect.

**Mr. Potter's Advice.**—The suggestions of Mr. Thomas Potter, which are based on the result of considerable experience, may be repeated here. He says: "Almost the first matter which the Clerk of Works should do after having obtained possession of tracings of the general drawings is to check the plans; that is, to ascertain that all figured dimensions in detail correspond with the full figured dimensions. For instance, assuming that on the plan of a church the dimensions are given of width of buttresses and the spaces between them, constituting together the full length, say, of the nave; these should be added together, and if the total is the same as the

extreme length, it is evidence of the figures being correct. All plan dimensions of a building should be gone into in this way, and as soon as time permits the sections showing heights dealt with in a similar manner, and the headways of stairs should have considerable attention, for difficulties often crop up in this respect which should have been remedied in time. When the plan is drawn to a small scale it is often advisable, where time permits, for the Clerk of Works to reproduce on a larger scale,  $\frac{1}{4}$ -inch to a foot at least, a 'working plan,' and figure thereon all dimensions, whether given in the original or not, which will be required in setting out the work. It should be traced on linen, or stretched or mounted on a deal framed panel with a light deal cover or flap hinged to the latter with webbing, so as to open and close either way, with a view of protecting the plan from rain and dirt. By taking the very earliest opportunity of calling his Architect's attention to discrepancies, instead of creating offence thereby, the Clerk of Works will obtain credit for his astuteness in detecting small errors in an early stage of the work, and without the

necessity of alterations having to be made and a Builder's extra created. Where the dimensions on plans and sections are not figured in sufficiently, or but very sparsely, it is well for the Clerk of Works to do this himself, in his office; indeed, he cannot well add too many figures, so long as the remedy is not worse than the evil through rendering them too confusing and intricate. For certain works—extensive alterations, for instance—where dimensions have to be taken to enable plans to be prepared, and existing buildings cover the site, it will often be found when old portions of the buildings are removed that there are considerable variations in detail, although the plans in the main are correct, and in such cases a working plan, with the various breaks, set-offs, and openings, figured in or laid down to a large scale, is almost a necessity if blunders are to be avoided. The dimensions figured in, or scaled off, detail drawings shall be compared with the general drawings at an early stage of the work, not left till the work has to be put in hand, and if an error is found the Architect has to be communicated with. So with the specification: if the latter specifies certain things to be done

which are impracticable from local or other causes, ample notice of this should be sent to the Architect that the subject may have proper consideration."

**Foreign Documents.**—It will sometimes be the case that a set of drawings for a building to be erected in Great Britain is prepared by a French Architect or Engineer and the whole of the dimensions are metrical. These dimensions must be translated into English feet and inches or (and it is probably better) a French metre tape should be obtained and the back of it marked with the corresponding English feet and inches; a rod about two metres long should also be prepared with metres and decimetres on one face, and English feet and inches on the other; these can be obtained to order from a mathematical instrument maker, and will save much trouble.

If the specification is in French, there are professional translators in London who will translate it into English.

Documents produced in other foreign countries can be similarly treated.

**Relations with the Architect.**—It is usual for the Clerk of Works to furnish the Architect

with a weekly report of progress, and he is generally furnished with printed forms which he periodically fills up. Such a form is given on the next page.

Whether a form is used or not, the Clerk of Works should report weekly to the Architect what work has been done during the week, the number of men employed, whether work is going on more slowly than is reasonable, the quality of materials delivered or their rejection, the weather, drawings received or required, the state of the works.

Some forms of report include a statement of the value of the work done since the last report, and of the materials on the ground. Special cases may require this treatment, but generally it is better made a subject for special report for certificate.

Some Architects show on the back of their report an outline plan of the proposed building, adopt a datum line, and request their Clerk of Works to figure each week on the various walls their heights above such datum at that time.

Photographs are in some cases taken at stated intervals as records of progress.

REPORT OF WORKS.									
No. .		In progress at		from		or		to	
				To Alfred Waterhouse, R.A., Architect, 20, New Cavendish Street, London, W.					
Workmen employed.		Value of work since last report.				Weather.		Drawings received.	
No.	Trade.	£	s.	d.					
	Excavators .. ..	..	..	..	Monday .. ..	The numbers of the drawings need only be stated.			
	Bricklayers .. 1/2	..	..	..	Tuesday .. ..				
	Masons .. ..	..	..	..	Wednesday ..				
	Carpenters and Joiners ..	..	..	..	Thursday .. ..				
	Slaters .. ..	..	..	..	Friday .. ..				
	Plumbers .. ..	..	..	..	Saturday .. ..				
	Glaziers .. ..	..	..	..	Sunday .. ..				
	Plasterers .. ..	..	..	..	Drawings required.				
	Painters .. ..	..	..	..					
	Labourers .. ..	..	..	..					
	Value of work previously executed .. ..	£							
	Total .. ..	£							
	Value of materials on the ground, but not fixed ..	£							

DAY WORK.—The Clerk of the Works is requested to get from the Contractor every week an account for any day work that may have been done during the previous week. Each account should state the names of the workmen engaged and the number of hours occupied, describe the work done, be signed by the Foreman and Clerk of Works, and sent up without delay to the Architect.

PRESENT STATE OF WORKS.



The Clerk of Works should keep a copy of each weekly report.

The Clerk of Works should ask in good time for any drawing or detail he may require, and will thus avoid blame for delay.

**Tabulation of Questions.**—A series of questions either from Clerk of Works to Architect or the reverse is most easily managed by putting them on a sheet of paper divided equally by a vertical line, heading one column Questions the other Answers. The Questions will be written in the first column and despatched, the receiver will then write his Answers in the second column and return it.

The Clerk of Works, when expecting a visit from the Architect, should prepare a list of questions beforehand, and so avoid troubling him with intermittent enquiries.

**Reports for Certificates.**—If the Quantity Surveyor is not employed to report for certificates and the Architect does not do it himself, the Clerk of Works will be called upon to do so. He should keep a copy of this report and the measurements upon which it is based. The priced quantities are of great use in the preparation of such a report; if there are no

quantities the work must be valued at current rates. Up to a certain point of the progress of the building the value of the work *done* is calculated, but when the building approaches completion the value of the work *unfinished* may be calculated and deducted from the contract sum, to estimate the value of the work done.

A set of tracings, upon which may be indicated by a tint the work valued and reported on for each certificate, often proves helpful. A pale tint of yellow or red washed over the whole of that part of the building of which the value has been reported is a practical expedient.

**Conditions of Contract.**—The Clerk of Works should carefully study the conditions of contract, noting any that affect the value of the work.

If he finds a condition that “the work shall be done according to the true intent and meaning of the drawings and specification, and whatever cases of discrepancy occur the Architect shall decide which shall be followed,” the Clerk of Works should take care that any issue as it arises is clearly and correctly placed before the Architect, as it is a case for settlement by

him alone; or if he finds a condition, "Should anything necessary to the perfection of the work have been omitted in either the drawings or specification or both of them, the same shall be included in the estimated price as if it had been shown or set forth in both," it will sometimes be found difficult to enforce; such a condition must be interpreted by common sense and in accord with the rest of the work. For instance, if an opening has no door described for it a door must be supplied like the adjacent ones.

Some Architects refrain from attaching conditions to their specifications, embodying them instead with the contract; this practice puts the Clerk of Works at a disadvantage.

**Regulation of the Work.**—When work is to be measured and a schedule of prices applied the Clerk of Works may often materially modify its cost by regulating the method of execution. Sometimes delay in the digging of the trenches next to a street may save basketing all the rest of the digging, and in many cases superior judgment may ensure economical methods instead of wasteful ones, which would otherwise have to be paid for.

Similarly in cutting away and making good for gas-fitters, electricians, &c., it is advisable wherever practicable to put on a minimum number of men and keep them on it as regularly as possible; putting a large number on and taking them away now and again is against the interest of both client and Contractor.

See that General Contractors' men do not damage the work of specialists.

**Clerk of Works to mind his own Business.**—The Clerk of Works should take care to confine himself to his own business, and should be careful and reticent, especially in his interviews with the Building Owner.

**Directions to be in Writing.**—Instructions to either the Contractor or his Foreman, especially if involving dimensions or differences in value, should be in writing, and copies should be kept. But as a rule the Clerk of Works should not furnish dimensions to the Builder, as he thus involves himself in responsibilities not properly his—he should give general directions, and leave the Builder to take his own dimensions.

**Not to direct Processes.**—It will be generally expedient to avoid giving directions as to

processes. The Clerk of Works should order the doing of the work, and leave the process to the Builder.

**Figures in Drawings.**—The Clerk of Works should note in pencil on his set of drawings any dimensions arrived at by calculation; they will record the history of the building, and probably prove useful in the future.

Figures on working drawings usually denote distances between brickwork or timbers of the carcase. If the internal openings are figured, it should be ascertained whether the dimensions of finished openings or brick openings are intended.

Test the sizes of the rooms and their height to see that they agree with the plan, and if intended to be rectangular, see that they are so.

**Remonstrances in Writing.**—If the Clerk of Works finds his directions are disregarded, he should put them into writing and deliver them to the Contractor; if they are still ignored, he must appeal to the Architect; but he should avoid this appeal if possible, as it is in some degree a confession of weakness, and he should endeavour to manage the work without troubling the Architect. One of the reasons for his

employment is the relief of the Architect from those petty worries which are inseparable from building operations.

**Not to interfere with Workmen.**—It is not generally advisable for a Clerk of Works to interfere directly with the workmen. If he sees anything to which he objects, he should complain to the Foreman, whose authority it is important to uphold.

**Temper.**—To avoid loss of temper and an imperious manner, to be strictly just in his requirements, inflexible in his purpose, and kind in manner, without forgetting his position, will ensure respect and compliance for the Clerk of Works, and he may be reminded that when everything is going on satisfactorily, the less he interferes the better.

**Quarrels.**—Altercations between Clerks of Works and Foremen culminating in an assault by one or the other are not unknown; but it takes two to make a quarrel, and when it does occur one may generally conclude that it might have been avoided, and that both men are in fault.

Sometimes the cause of quarrel has been the destruction of work not in accordance with the contract and which the Builder has refused to



remove. The breaking of a defective stone with a hammer, or smashing objectionable glass—such action is gravely mistaken, and should be avoided.

**Objections to be Prompt.**—The Clerk of Works should object to work as soon as he has reason for objection. It is the regular and deliberate practice with some Clerks of Works to allow an objectionable piece of work to be nearly finished before they make any complaint. Such a course is contemptible.

**Protection of the Work.**—The efficient protection of the work, even if not mentioned in the specification, may be insisted on without involving an extra charge, but care should be taken to avoid the ordering of specially expensive methods. The Contractor is bound to leave his work perfect, but it should be remembered that it is less difficult to obtain protection of work than its repair or renewal if damaged. Often for want of care, parts of a building are injured in a most unsightly manner, but the damage is not sufficient for insistence upon the renewal of the part in question.

In alterations to existing buildings such care is especially necessary. Staircases are not

infrequently ruined by rough traffic, which might have been easily avoided.

No rooms where finishings have been done should be used as workshops or messrooms; the use of rooms of old buildings for such purposes should also be carefully regulated.

It will be especially necessary to prevent damage by the General Contractor's men of work done by a separate Contractor.

The protection of work prescribed to be repaired and refixed is often shamefully neglected, and when the time comes for its refixing it is found to be damaged beyond repair, or parts of it lost. The careful Clerk of Works will avoid this, and generally he will spare ultimate trouble to himself and the Contractor if he prevents defective storage of materials liable to damage.

If the work is in a garden or park the Clerk of Works will earn the gratitude of the proprietor if he prevents the men from trespassing beyond the limits required by the building operations, by preserving the trees, turf, drives, paths, and fences from injury by wilful acts of the men, as carting, making paths for themselves, or the like. When work is stopped for a period

Clerk of Works should direct all the expedients for its protection before he leaves it.

**Shoring.**—Although it may be clearly to the Contractor's interest to take every precaution, the Clerk of Works will often find it necessary to insist upon more thorough shoring of adjoining properties, since their fall from insufficient support commonly raises a number of curious questions of liability which it is most desirable to avoid.

The Clerk of Works should carefully watch shoring; should insist upon liberal strength; should see that neither shoring nor centering is prematurely removed, and that both are gradually eased before final removal.

**Notices.**—The Clerk of Works should see that nothing is done to infringe by-laws or Acts of Parliament, and that the contractor gives the requisite notices.

**Protection of Workmen.**—The Clerk of Works should call attention to any neglect of precautions for the protection of the workmen, not only for humane reasons, but to preserve the Builder from pecuniary loss, and if he can in any way assist the Foreman without assuming a responsibility which properly attaches to the Builder,

he should certainly do so, if only for the sake of that good fellowship which so largely affects the successful progress of a building.

**Scaffolding.** — Although the design and management of the scaffolding of a building is a duty of the Contractor, and he being mindful of his obligations under the Employers' Liability Act and Workmen's Compensation Acts, is usually careful, the Clerk of Works can often render him and the workmen valuable service by calling attention to want of care or skill in the construction of scaffolds—insufficient bracing of the poles, inadequate strength in the legs of tripod supports for cranes, or the general strength of the gantries. The Clerk of Works should look for traps in the platform of scaffolds; for ladders too short for the altitude of scaffolds. Any ladder, the end of which does not stand up 4 feet above the scaffold platform to which it gives access, may be considered dangerous. The ascent from the ground is apt to become mechanical; the workman as he rises may heedlessly continue to slip his hands along the sides of the ladder, and in the case of one the top of which projects only a short distance above the platform may suddenly lose his hold.

**Sub-letting.**—The ordinary condition about sub-letting is rarely enforced, and the Clerk of Works should ignore the existence of a sub-Contractor unless the fact is forced upon his notice, in which case he should enquire of the Architect whether he will tolerate the arrangement, but in no case should he treat with such sub-Contractor, or accept his responsibility.

**Written Orders.**—If written orders for extra works are required by the conditions, the Clerk of Works may legitimately help the Builder by getting them furnished.

**Day Accounts.**—Work done at the same time as the contract work and not involving alteration, may reasonably be left for measurement until the time for the adjustment of the accounts. But work in the nature of jobbing and alterations is usually and properly treated as day work.

Conditions of contract usually stipulate for the delivery of day accounts during the week following that in which the work is done. The Clerk of Works should insist upon the observation of this condition, and he must keep an account from his own observation of the time and materials daily expended on the work in question. A writer in the "Journal of the Clerk

of Works Association" gives the following good advice:—

**Clerk of Works Advice.**—"Every morning the Foreman comes to my office with his book and gives me an account of time and materials employed in day work during the preceding day. When satisfied that it is correct, I enter it in ink in a book kept for the purpose. Should there be any dispute the question is gone into then and there, and it is easy to verify what took place on the previous day. At the end of the week I receive a day work sheet and two duplicates; as the items have been previously agreed to, it is then merely a clerical matter to check them; after which I sign and return one copy to the Contractor and one to the Architect, keeping the other myself for future reference. I generally insert the following notice in No. 1 sheet:—"I sign this and succeeding sheets as being a correct record of work done and materials employed on the different works, but not necessarily as being extra." If I have any doubt whether a thing is extra or not, I keep the time and allow it on the sheet to be dealt with by the Architect or Surveyor. I have often found that work I had refused as day work had, after all,



to be settled by myself and the Foreman agreeing to what we thought was right, and in some cases having to take the unchecked time claimed by the Foreman."

When accounts are required in separate sections, such as attendance on one particular tradesman, as a hot-water fitter or electrician, the Clerk of Works should be informed, so that he may arrange with the Foreman to keep the time and materials for such work on separate sheets.

**Day Work should be Separate.**—The work in a particular alteration treated as Day Work should be kept separate from any other alteration.

A common characteristic of day accounts is the jumbling together of several items of work done in different parts of the building, a practice which makes any independent check almost impossible.

**Prices.**—Day accounts, with prices attached, should not be accepted. Their acceptance may lead to the presumption that the prices have been agreed; this is no part of the Clerk of Works duty, and prices are best left to be settled by the persons who adjust the variations.

**Uniformity of Measures.**—The Clerk of Works should endeavour to insure uniformity in the measures of materials supplied ; this is not the common practice: mortar, for example, often appears as hods, loads, yards, bushels, pails, and barrows in the same account.

The day accounts should show clearly whether wood is rough or wrought, what work is from bench or banker, and whether the time charged is for preparation and fixing, or for fixing only.

**Cartage.**—Some Contractors attempt to charge cartage of ordinary materials in day accounts; this is one of the items of working expenses which the profit should cover like other establishment charges.

In the case of such goods as stoves, baths, sanitary apparatus, &c., the cartage will be one of the factors used in calculating the value.

The rate for time in day accounts is usually settled by a schedule attached to the form of tender, and in some schedules appears the following clause :—

**Scaffold—Tackle—Tools.**—“ The prices for time and day work generally to include use of scaffold and all tackle, tools, tool sharpening, and general Foreman’s time. Subordinate Foremen

to be charged as ordinary workmen. Time for fixing and removing scaffolding will be allowed."

**Foreman's Time.**—When there is no condition in the contract, Foreman's whole time should be allowed on work requiring his exclusive superintendence, as on jobbing, when all but the men whose time appears have been discharged. A proportion of his time should also be allowed on special works done during the general progress of the building and requiring an undue amount of supervision.

**Removal of Materials from the Site.**—The Clerk of Works should prevent the removal from the site of any material which has been included in the calculation for certificate.

**Condemned Materials.**—See that these are promptly removed from the site, as otherwise they may be used despite their condemnation.

**Mounting of Tracings.**—If tracings are furnished by the Architect they should be mounted either on linen or a thin board, the figured dimensions carefully checked, and others inserted where required. The drawings should also be carefully examined for errors or faults of construction, or for any points which require explanation.

**Adjustment of Variations.**—When the building approaches completion, the Clerk of Works will probably be asked for a list of items of omission and addition (items, not quantities), to be dealt with by the Measuring Surveyor. The Clerk of Works will produce this with ease, if he has noted in his book variations as they occur. The Contractor will also produce a list if requested to do so.

**Materials.** — If the specification properly describes the quality of the materials, item by item, the duties of the Clerk of Works will be simple: he has only to insist upon what is described.

If it contains only a clause, “all materials to be of the best quality,” his course is not so clear. There are so many trade definitions of “best,” as “best best,” “double best,” &c., that some Architects use a specification clause—“By the word best it is to be understood that there is no better quality,” or “The word best when used in this specification shall be taken in its ordinary English sense, notwithstanding any trade custom to the contrary.”

Generally a given case resolves itself into the acceptance of materials of the best quality which

may reasonably be required for the particular purpose.

The general directions as to labour and materials in the following pages are such as may be insisted upon without involving an extra. They are the elements of work done in a good and workmanlike manner.

**Attendance.**—A clause usually appears in the specification, “Each trade to attend on all others, and do all jobbing work required.” Such a clause implies that all trades shall attend upon, cut away for, and make good after all others, except to gas-fitter, bell-hanger, and hot-water engineer, as for conservatories, &c.; but the clause covers domestic hot-water supply.

When quantities have been supplied, the Surveyor has usually, besides introducing the above clause, measured all holes for plumbers’ pipes, cold and hot, chases, &c., and he has also made his description of gas-piping including attendance. He has probably also taken attendance of joiner to each article of apparatus, as sinks, baths, w.c.’s, &c. What has been included may be ascertained by reference to the bill of quantities, but this is only necessary when the quantities are a part of the contract. When

they are not, the Contractor is bound to produce a reasonably complete building, whatever the documents may express.

**Fixing Gas-fittings.**—The fixing of gas-fittings and bell-pulls will be extra if not specified, and the times and material used should be noted.

**Templates.**—As a general rule, the Builder is bound to furnish, without extra charge, the necessary dimensions and templates for the whole of the work included in the contract, except that for which a sum is provided.

**Specialist doing his own Cutting away, &c.**—Some Architects stipulate and maintain that it is cheaper in the case of Specialists, like electricians, heating engineers, &c., that they shall do their own cutting away and making good. This arrangement always gives the Clerk of Works more trouble than the ordinary one. There is a natural tendency with the Specialists to be careless with the General Contractor's work.

**Attendances in Quantities.**—It should be noted that there is a growing tendency among Surveyors to put into the bill of quantities everything in the way of attendance that can be so comprised.



When a Specialist is employed, as for cooking apparatus, laundry apparatus, heating, or ventilation, the Quantity Surveyor obtains from such Specialist the particulars of the whole of his requirements in the way of General Contractor's work, and puts them in his bill of quantities. The necessity of a provisional sum for attendance on such tradesmen thus disappears. The labours are clearly defined, and often in a separate bill.

**Extra Works.**—It is necessary that the Clerk of Works should clearly realise what works are extra, and he must understand that the circumstances are very different when the quantities are a part of the contract, and when they are not.

In the former case everything which does not appear in the quantities, even though it may appear in the drawings or specification, or both, is extra. Variation on any item of the work, whether an excess or deficiency, is adjusted at the settlement of accounts, and is either added to or deducted from the amount of contract.

When the quantities are not a part of the contract, the drawings, specification, and ordinary legal obligations only apply. The Building Owner has nothing to do with the

quantities, and consequently their excess or deficiency does not affect him. In such a case the Builder is bound to carry out the work according to the drawings and specification, and is even bound beyond that to make a complete building according to a reasonable interpretation of what such building should comprise. If, for instance, a roof, a staircase, or a doorway, is naturally involved by the scheme of building, their omission from the specification will not be a reason for charging them as extra. A roof, staircase, or doorway, reasonably consistent with the rest of the work, must be supplied without extra charge.

Legal obligations such as these are frequently evaded, or such work allowed as extra by a complaisant Building Owner or his Architect. It is beyond the province of a Clerk of Works to settle such questions. He should refer them to the Architect, and can then make his notes accordingly.

**Ordering of Extra Works.**—The Clerk of Works should not order Extra Works. Some Architects adopt the following clause in their Conditions of Contract:—

“The Clerk of Works or Agent of the

Architect shall have no power to order any Extra Works, or deviation from the Specification and drawings, and the Contractors will have no claim for Extra Works ordered by him."

**Setting Out.**—The conditions of contract should include a clause stipulating that the Contractor shall set out the building. The clause in the conditions issued by the Royal Institute of British Architects is as follows :—

"The Contractor shall set out the works and during the progress of the building shall amend at his own cost any errors arising from inaccurate setting out unless the Architect shall decide to the contrary."

The Clerk of Works should not set out, but should check the setting out after it is done. But although it is not expedient for the Clerk of Works to adopt a responsibility which properly belongs to the Contractor he should carefully watch the operations and call attention promptly to anything which is palpably wrong.

Probably the best way to set out is to strain a line the whole length of the axis of the building and measure dimensions to the right and left of it. It is also important that the longest dimension possible should be marked

and afterwards subdivided rather than short dimensions marked to make up such longer lengths; the result of the latter process is a possible accumulation of small errors.

The use of rods is safer than measurement with a tape.

**Tests.**—For the testing of cement, iron and steel it is usual to provide a sum to be spent as required; such testing is done by a Specialist in such investigations at his own works.

The Clerk of Works will note the time expended in loading and unloading and the extent of the cartage.

**Quality of Materials.**—Goodness of material and workmanship may be most safely insured by reference to samples, deposited by the Contractor before the signing of the contract or to samples already in the Architect's possession—as bricks of various kinds, stone, terra-cotta, mahogany, pitch-pine, oak, teak, &c., articles of ironmongery, plumbers' brass work, hot water valves, castings for sewer work, &c.

Ironmongery of good quality may be ensured by specifying the prime cost of each article, or a list of the ironmongery may be sent to a selected manufacturer, that he may attach his

prices, and the total may be included in the contract as a provisional sum. The manufacturer should be one who really does supply articles of superior quality, otherwise the work may just as well be left to the Contractor.

The quotation of numbers from trade lists is another familiar way of defining quality.

**Provisional Sums.**—The Clerk of Works should make notes of the expenditure of provisional sums, especially of the work which may be concealed, also of the use of provisional quantities of materials or labour, as rods of brickwork, cubic yards of digging or concrete, cubic feet of timber, &c.

## FOUNDATIONS.

**Levels.**—If the site is sloping ground care should be taken that the building is put in position shown on the drawings. A change of position in such a case sinks the building deeper into the ground or exposes it more. If this is done the Architect's attention should be called to it, and levels of the surface and their relation to a given datum, such as the general floor level, observed and noted, or they may be referred to a bench mark legibly cut. For a

rectangular building facing the points of the compass the levels should be taken at the angles and described as N.E., N.W., &c.; other intermediate levels should be taken along the line of the walls wherever the level changes.

**Extra Digging and Concrete.**—When extra digging or concrete occurs the measurements should be made with the Contractor's Foreman, and the exact position stated.

**Notes of Character and Depth of Excavation.**—Sometimes the Contractor is ordered to dig deeper than at first intended, and the character of the soil at the greater depth often proves altogether different to that nearer the surface, or water, or running sand, or rock may appear, involving much pumping, close boarding of the trenches, or even sheet piling, removing the earth with scoops or buckets, or work equal to quarrying. In such contingencies claims for extras, often greatly exaggerated, originate, and the Clerk of Works may render valuable service to his employer by making careful notes of the time occupied on the items of work, so that the price per yard for digging under these altered conditions, the extent of pumping, the



extra cost of carting, &c., may be more easily valued when the variation is adjusted.

With the increased depth the width of the trenches may possibly be increased.

**Water in Trenches.**—The specification should contain a condition as to keeping the foundations free from water, as “keep foundations free from water and do all baling or pumping required.”

Although the presence of this clause saves argument it is probably not absolutely necessary to the enforcement of the work. Dry trenches are so essential to the production of good work that the Clerk of Works should insist upon their being kept clear of water.

**Bottoms of Trenches.** — The bottoms of trenches, although they may be when first dug quite hard enough to receive the concrete, will after a week's rain, if pumping or baling be neglected, become a bed of mud several inches deep, which will probably require to be removed and an extra claimed for it. If the footings are in the brickwork will be seriously damaged by saturation with water.

**Concrete.**—If the concrete for foundations is shown on the drawings of less proportion than six inches each side beyond the lowest course of

footings, or the depth shown appears to be too little for the proper support of the building, the Clerk of Works should consult the Architect.

Although possibly wooden measures cannot be insisted on, unless specifically mentioned in the specification, the materials should be roughly measured rather than thrown down and mixed at hazard. Large stones should always be broken, they should certainly be capable of passing a 2-inch ring, all rubbish should be excluded, and the surface properly levelled to receive the brickwork.

The Clerk of Works should see that the concrete laid on a previous day be well wetted before another layer is put on.

**Concrete Floors.**—Concrete floors should be protected from sun, wind, or frost, by planks or sacking, and in hot weather the sacking should be well wetted. This protection should be done immediately after laying, and should remain about seven days ; no traffic of any kind should be allowed over concrete floors for at least seven days after laying, and no materials or plant with the exception of any necessary protecting boards should be deposited on the concrete within that period.

**Concrete Partitions.**—See that the boarding is sufficiently rigid to ensure surfaces true enough to receive a setting coat of plastering, and do not allow the boarding to be removed until seven days after the construction of the partition.

**Concrete Walls.**—See that concrete exposed to hot sunshine is covered with wet sacks, and when left for a time, for raising upon, kept clean, and left rough and well watered, to receive the next raising. Build in all work, such as ends of timbers, steps, air bricks, plugs, &c., and avoid cutting away after the concrete is set.

In using coke breeze take care that it is not too fine and that it is properly screened.

A common stipulation is as follows :—

“The coke breeze to pass through  $1\frac{1}{2}$ -inch mesh screen and none is to pass through  $\frac{1}{8}$ -inch mesh screen.”

**Centering.**—The centering of concrete floors should be left untouched until the concrete is quite dry and eased before final removal. Easing is more conveniently done when the centering is suspended rather than strutted up (“horsed”).

**Rubbish.**—The rubbish used to level up

should be hard brick or stone properly broken up, free from shavings and soft stuff, and sufficiently rammed. If earth is used instead, see that it is thoroughly rammed and rolled, watering helps consolidation.

**Old Drains or Cesspools.**—If old cesspools or wells are discovered on the site, they should be cleaned out and filled up with concrete, hard dry rubbish, or lime core. If there is no mention of such contingencies in the specification, the work will be extra, and notes should be made of the time and materials used.

Lines of old drains should be cleaned out if not removed, and may be filled up with concrete pushed in from the ends. This work, if not specified, will also be extra.

When the existence of old drains or cesspools is suspected, the specification will probably contain a provision of a number of yards of concrete to be used for filling them in. It will be the duty of the Clerk of Works to take note of the quantity used, so that it may be dealt with at the time of the adjustment of the accounts.

**Drains.**—The Clerk of Works should carefully supervise these, and not let any be covered up until they have been finally cleaned out and

tested, nor allow any one to walk on them. He should also see that they do not fall in the wrong direction; that the bottoms of the trenches are hard, and if there are soft places ask the Architect's permission to fill up such places with concrete, and take notes of the extra concrete used. If it should be necessary to ram the bottoms, and there is no mention of it in the specification, a note of the time expended should be taken. Take care that the pipes are not broken or disturbed by careless ramming of the filling.

See that each length of pipe is straight.

**Testing.**—If the specification provides for testing the drains, it should be done as prescribed; if not, they should nevertheless be tested, and the Clerk of Works should take note of the time as an extra. He should take care that no curves are produced by straight pipes, and that the branches run diagonally into the main lines of pipes. For the water test, the lower end of the line of drain being plugged and the drain filled with water, watch carefully for any subsidence during a given time, and if it occurs note its extent.

**Puddling.**—If puddled clay is specified, see

that good plastic clay well puddled and free from stones is used.

**Cleaning out.**—Each pipe should be cleaned out before another is laid. If bends can be avoided by a slight change of course it is better to do so and thereby facilitate the cleansing.

**Half-socketed Pipes.**—The judicious introduction of a few half-socketed pipes at intervals will also facilitate cleaning. The extra cost will be small. If tested pipes are specified, the Clerk of Works should see that each length of pipe is marked T or reject it. A defective pipe, even though marked, may be rejected.

**Drain Plan.**—A drain plan should be made to scale if none exists as a working drawing; if there is such a drawing, it should be corrected for any alterations. This will be valuable to the building owner. It is customary with a drainage system of any size to frame a drawing of it and hang it in one of the domestic offices of the building.

#### BRICKLAYER.

**Bricks.**—The quality of the bricks will be defined by the specification. The Clerk of Works should not allow the use of broken



bricks anywhere, either in general walling or facing, nor of bats, except for closers.

See that bricks are carefully unloaded and deposited.

Many specifications stipulate that no broken bricks or bats shall be used, but the following makes decent work:—

“Execute stretching courses with whole bricks except where closers are required. In heading courses not more than one snapped header to three whole bricks is to be used, and the snapped headers must be separated by at least two whole bricks. Footings, corbel courses, and oversailing courses are to be of whole bricks, except where closers occur.”

**Mortar.**—See that the lime is fresh and thoroughly slaked; that the prescribed proportion is used in the mortar, and if not described, a reasonable proportion to make mortar, the test being its proper hardening by exposure. Less than one part of lime to three parts of sand should never be accepted, and it should be mixed in quantities sufficient only for daily use.

See that lime is kept under cover.

**Sand.**—Care must be taken that the sand is

free from salt. Perhaps the readiest test is to taste it, but, whatever the specification says, it should be rejected if it contains loam.

**Ashes.**—Sometimes, where sand of a decent quality cannot be procured except from a long distance, engine ashes, usually procured from a railway depôt, are used in its place.

**Cement.**—Cement should be spread out and exposed on a dry floor before it is used. If tests are specified and insisted on, it will be the Clerk of Works' duty to see that they are carried out. As a rule they are conducted by a professional tester of building materials. Sometimes a sum of money is provided for this general testing of materials; if so, the Clerk of Works should keep an account of the time expended on loading, unloading, and carting.

Especially in hot weather, cement used direct out of the cask will sometimes fall off the work soon after its application.

See that cement mortar is used fresh.

**Flushing.**—Take special care to have every joint filled with mortar. Brickwork if left to the Builder is usually full of cavities, and the getting them filled involves more rigid supervision than any other part of the work.

**Perpends and Quoins.**—See that the brickwork is carried up regularly all around the building; that the quoins and the jambs of openings are exactly upright; that the vertical joints properly break joint, and that perpends are kept where possible. The Clerk of Works should understand the various bonds of brickwork, and see that he gets them. Often he does not.

**Old Bricks.**—In using old bricks either reject sooty bricks altogether or see that they are only used in the middle of thick walls.

Brickwork should not be allowed to stand in water, nor to be damaged by wet or frost for want of protection.

**Sleeper Walls.**—If built solid leave holes through them for ventilation.

**Wood Bricks.**—Pads, wood bricks, or plugs should be built in so as to avoid shaking the work by their insertion after it is built;  $\frac{1}{2}$ -inch pads or breeze concrete blocks are best.

**Sand Courses.**—Ends of steps, timbers, terracotta, &c., which may not be delivered in time, may be prepared for by laying courses of bricks in sand, and delay will thus be avoided.

**Attendances.**—The Clerk of Works should

notice what is included in the contract for bricklayers' attendance on such trades as plumber, gasfitter, bellhanger, &c., so that he may know for what works the Contractor may properly claim an extra.

**Setting Stoves.**—Find out, if possible, what stoves are to be used before forming the chimney openings, and see that the openings are formed somewhere near the size of the backs. Often the backing of the stove is mere rubbish, but a space of at least  $4\frac{1}{2}$  inches should be left around the backs to receive materials of setting. When fire-brick backs are in large slabs they should not be set too solidly or they will crack.

**Arches.**—All arches, including the relieving arches, should really act as arches.

**Cement Work.**—All sand used for cement mortar should be washed, and all bricks wetted in very dry weather.

**Flues.**—The Clerk of Works should specially watch the pargeting of flues, and if cow dung is specified insist upon its use. He should have all the withes and brickwork around flues filled with mortar, and all awkward and sudden angles in the flues or pockets which may hold

the soot avoided, and where a near approach to the horizontal is inevitable, he should suggest the introduction of soot doors. Flues from kitchen ranges passing up through other rooms should have 9-inch work all around them ; if not so shown the Architect's attention should be called to it. In good buildings all flues should be thus treated.

When flues adjoin an exposed flank wall which may be afterwards built against, it is advisable to mark the lines of the withes in white paint on the outer face of the wall. If this is not done, there is danger of their being accidentally cut into by a future builder. See that they are left clean at completion by passing a sweep's brush (or the like) through them. Sometimes bricks and rubbish are left in them.

See that the size of flues is maintained throughout, and that no timber runs into smoke flues.

**Cement on Tile Pavings.**—Cement should be cleaned off tile pavings immediately after they are laid, or they will be permanently stained.

**Frost.**—Brickwork should be stopped during sharp frosty weather. Sometimes in cases of urgency it may be built in cement without

sustaining injury, but it is better stopped. It must be carefully covered and protected until work is resumed, and before raising on the walls all the upper courses where the mortar has perished should be removed.

**Underpinning.**—Special care must be observed in underpinning; it should always be done in lengths of not more than 3 feet, built of the hardest bricks in cement, and well wedged with slate or iron wedges. If after all precaution cracks appear in the old work, their behaviour should be carefully observed and noted. The progress of the settlement may be seen by pasting strips of paper across the cracks, and if they increase in width they will break the paper.

**Timber left in Trenches.**—If it should be necessary to leave any of the strutting and planking in the excavation (and it often is necessary), the Clerk of Works should measure it with the Foreman.

**Facings.**—In the facings of walls with better bricks than those for general walling, the Clerk of Works should see that the common practice of snap-headers, as they are called, is prevented as much as possible. Often the facing bricks



are so large that they will not course with the ordinary bricks. In such a case an occasional course of bricks on edge will help to obviate the difficulty. Bricks not rectangular, or with convex ends or sides, should be rejected.

**Pointing.**—Pointing, after it is done, is often badly injured by frost, and its renewal is a frequent subject of dispute. If there is a clause in the specification “make good all pointing to brickwork, roofing, &c., after injury from frost,” there can be no doubt but under the ordinary clause for maintenance the Builder is bound to deliver his work perfect and to make good any work which may fail during such period of maintenance.

**Glazed Facings.**—Second quality glazed facings are often supplied where first quality are specified, but even although the manufacturer may supply them as best quality, objection should be taken to defects such as bad colour, cracks, or chips.

**Hollow Walls.**—If hollow walls are used, the Clerk of Works should see that the necessary precautions are taken to prevent the fall of rubbish or mortar into the hollow. The leaving of openings at the base of wall until the

completion of the brickwork will make the clearing out of such droppings comparatively easy. See that the prescribed number of ties is used and that both thicknesses of the wall are carried up together.

**Tall Chimneys.**—The building of tall chimneys requires special attention; the flushing of the brickwork should be well watched, and the work should not be built in cement. The fire-brick lining should not be bonded to the general brickwork, nor should the work be built very quickly. See that they are not bonded to adjoining buildings.

#### TERRA-COTTA.

**Unpacking.**—Work in terra-cotta requires much attention from the Clerk of Works. If it is not very carefully unpacked, stored, and handled, it will get many unsightly chips, and they must be submitted to or the work delayed to a very inconvenient extent while the defective parts are renewed. Attentive supervision will prevent this.

When a piece is unavoidably removed it may be replaced by sand courses while a new piece is being made.

**Details.**—It is properly the duty of the Architect to make details of the terra-cotta, and it is a work of considerable responsibility and trouble. Often small pieces, the necessity for which has been overlooked, have to be drawn by the Clerk of Works. He will draw the details in the same way as any ordinary details, and had better put a note on his drawing that the manufacturer must make his own allowance for shrinkage.

**Models.**—Sometimes the Architect arranges with a person other than the manufacturer (a maker of decorative plaster work or modeller, for instance) to make the necessary models under his supervision and supply them to the manufacturer, and this is probably the best way to ensure artistic work; in other cases, and more frequently, the manufacturer makes his own models. If a modeller is employed it may happen that nothing appears in the specification about the conveyance to and fro of models, offering up, &c.; if not, the Clerk of Works must make notes of the time thus expended.

**Delays.**—When the terra-cotta is to be supplied by stipulated instalments, the Clerk of Works may render valuable service by taking care

that the Builder causes no delay by the neglect to furnish any particulars required of him.

Delay from this cause is a frequent subject of dispute, and the Clerk of Works should make careful notes of all that he knows about despatch of orders and delivery of the material, both as regards quantity and dates.

**Storing.**—The storing of the terra-cotta so as to prevent its being shifted more than once is another preventive of damage. If terra-cotta which is wanted at an early stage of the building is packed under other terra-cotta which is wanted later the removal involves inevitable damage.

**Key Plan.**—For terra-cotta in large quantity a key plan, with numbers corresponding with those of the respective pieces, is furnished by the manufacturer, and this plan will assist the Clerk of Works to direct the storage and the fixing.

**Filling and Jointing Blocks—Distortion—Sand Courses.**—The Clerk of Works should carefully supervise the filling of the blocks and their jointing, and his judgment will often be tried to decide what amount of distortion he will permit in a given piece of terra-cotta, the balance being between the disadvantage of unsightliness and the delay which the waiting

for a new piece will involve. If he does reject a piece, the space to receive it may in certain cases be filled temporarily by bricks laid in sand. Some Architects insist upon the destruction of any rejected piece of terra-cotta so that it may not be used in any other building.

### MASON.

**Quality of Stone.**—The Clerk of Works should see that the stone is equal to the description and that it is set on its natural bed.

**Dowels—Tailing.**—If slate dowels are specified he should insist upon their use and not allow iron to be used for cramps. He should see that all the stones are properly tailed into the walls and properly bonded with the brickwork.

**Colour and Hardness.**—Stone should be of uniform colour and hardness; tooling and rubbing are often very imperfectly done. This should not be allowed.

**Thin Beds.**—The beds of stonework if too thin will cause the stones to fracture on the outer edges of the beds when they take their bearing.

Although the stonework, as quoins, jambs, &c., may be described as “to course with the brickwork,” the beds must be kept thinner than

those of the brickwork, and should certainly not exceed a quarter of an inch in thickness. They should in fact be "stone joints," and the stonework should be so set out as to favour this arrangement. The same rule will apply to terracotta, which should be treated in the same manner as stonework in respect of joints.

**Lead.**—If lead is used in the beds of stonework it should be in one sheet. The columns of part of the Holborn Viaduct were cracked in consequence of the lead in the beds being in detached pieces which acted as wedges under the pressure.

**Cement for Setting.**—The use of cement for setting stonework, especially where exposed to view, should be avoided.

**Dressings.**—The stones of dressings should hold their full length and height square to the back, and as a general rule stones of less than 3 feet in length should not be permitted in string courses, plinths, &c.

**Casing and Protection.**—All steps and stonework generally should be cased and thoroughly protected. Steps are best guarded by a layer of plain tiles in mortar laid all over the surface. These casings should remain until the very last, and be renewed whenever displaced.



**Storage.**—The advice given as to the storage of terra-cotta applies equally to the storage of stone. Terra-cotta can be washed but stone is usually dragged or rubbed to clean it; the result is often to spoil the evenness of original surfaces or the contour of the mouldings. To avoid discoloration the stone should be kept in a shed until required.

**Quarry Worked Stone.**—The use of quarry worked stone is becoming more frequent. A key plan is usually supplied by the quarry owner, and every stone is numbered; this will facilitate the order of the storage. As the Quarryman in many cases quotes at per foot cube he is naturally tempted to exaggerate the sizes. Where he does this without orders he should not be paid for the extra quantity, but sometimes the increase is not his fault, and in such case the Clerk of Works should take notes of such stones as differ from the original intention.

As the quarry invoices may possibly be produced as evidence of the alteration the Clerk of Works should see them, and check the measurement at the time of delivery or as soon after as possible.

Sometimes, by order, the Builder supplies

part of the stone which should have been supplied by the Quarryman; this also is a case for taking notes of size and position, as the price will be different.

Failure by the Quarryman to deliver at the stipulated time will probably affect the question of penalty for delay; the Clerk of Works should make careful notes of the circumstances and dates. Granite is almost invariably quarry-worked. Masons occasionally strike against the use of quarry-worked stone.

**Delivery.**—If the delivery from the railway station to the building should be shifted from the Quarryman to the Builder the Clerk of Works will take notes of the number of loads carted and the time expended on loading and unloading.

**Notes of Beds.**—In a contract there are two current ways of defining the beds of stone: one is to describe the bed of every stone in the specification, the other to figure the bed of every stone on the detail drawings. In every case where there is a departure from the intention of the contract, the Clerk of Works should make a note of the change.

**Mr. Moore on Setting Out.**—As before remarked, setting out is not the duty of the Clerk

of Works, but he should watch it carefully, so that he may regulate the jointing and guard against error.

Mr. Moore, in the course of a very sensible practical paper read before the Clerk of Works Association on the setting out of Gothic groined vaulting, gives the following valuable advice: "On receiving a small scale drawing from the Architect for the purpose of setting out a piece of vaulting I have found it a good plan to first set it down one-eighth full size on lining paper. By this means you will find out and master any difficulties that may arise, before laying it down full size. Another advantage is you can mark every joint on the paper drawing, and number each stone. When the mason has 'bankered' the stone you can write his name on the drawing; on referring to it you can ascertain if the whole of the stones are in hand, and should the mason make a mistake in the working of his job, as he sometimes does, you can at a glance see which man has made the error. You will invariably find, should the mason make a mistake and spoil his job, he forgets to put on his 'banker mark.' It is also a very good plan to make a model of

your groining ; in doing this the joints of the filling in of the spandrils can be marked on it. We all know it is very difficult for an Architect to show on his small drawing the exact direction he wishes the jointing of the filling in to take. I may here mention, during the erection of the Law Courts a small model one-eighth full size of one bay of each description of brick, stone, or wood groined vaulting throughout the building was made for Mr. Street's approval before the work was executed, and for the purpose of marking on the model the direction he wished the joints of the filling in to take, and this he invariably did with his own hands ; those models were clearly provided for in the specification."

These suggestions are valuable for application generally to stonework.

**Pavings.**—See that the joints are carefully squared, and that the bed is properly rammed and levelled ; if laid to fall, see that the fall is in the right direction.

If in parallel courses, see that the joints are parallel to the sides of the apartment, and that the bonding of the stones next the one wall matches that adjoining the other wall.

**Stone Bases.**—The Clerk of Works should specially watch the building of stone bases, which receive great weights, such as columns or stanchions of several stories one above another.

**Geometrical Staircases.**—In the construction of geometrical staircases accuracy of fitting and the sufficient tailing of the stone into the walls should also be carefully watched.

### STONE WALLING.

**Bond Stones.**—See that the proper or stipulated number of bond or through stones is used. If lined with brick see that the brick and stone are properly bonded together.

**Quality.**—The great variety of coursing, and finish of facing of stone walling make it difficult to reconcile what the Architect wants with what the Builder is willing to supply. Sometimes a specification refers to a well-known specimen of work in the neighbourhood of the new building, in other cases (and it is convenient and reasonable) stipulates that a specimen should be built thus :

“Allow for building a piece of walling as

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described, about 2 yards superficial and 18 inches thick as a specimen to be approved before commencing the work and for pulling it down and clearing it away when directed."

For walling faced with flint this is specially advantageous.

#### SLATER.

**Slating.**—The Clerk of Works should see that he gets the lap prescribed; two nails to each slate, and if of copper, of the weight specified; that the eaves are laid double, that all slates are closely and neatly cut, and fitted to vertical faces, hips, and ridges, and that the specified lap is observed.

**Hips and Valleys.**—To hips, valleys, and verges small pieces may be avoided by the use of larger slates, and this the Contractor will often be willing to do without extra charge.

**Plumber's Work.**—The Plumber's work should be done before any slates are laid, so as to avoid breaking them. Broken slates can never be replaced so as to make as good work as the original slating. Sometimes the Slater wantonly nails through the leadwork. This should never be allowed.



**Leave Gutters Clean.**—All gutters should be left clean at the completion of the building.

### TILER.

**Bedding.**—If tiles are bedded in lime and hair, as little as possible should be used. It should not reach as far as the tail of the tile, as if it does water will be drawn in.

**Hips and Valleys.**—Where hips, valleys, or gables occur, tile and half will often be necessary to avoid the use of very small pieces of tile. These may be introduced at a very small expense, and may reasonably be suggested to the Architect.

**Injury by Plumbers.**—The same caution as in Slater may be given as to nailing through the leadwork.

### CARPENTER.

**Quality of Timber.**—Whatever the specification may prescribe as to quality, the Clerk of Works may safely reject sapwood, large, loose, or dead knots, and wood wet or unseasoned.

Some specifications say: "Where timber is freely exposed to the air it will be accepted with a maximum of 5 per cent. of sap."

**Brands on Wood.**—It is injudicious to depend slavishly upon brands of timber or deals; they may be taken as a general guide, but they are not conclusive. There may be bad material with a good brand. Parcels of timber and deals sometimes have the best pieces selected, withdrawn by the timber merchant, and sold at an enhanced price, leaving the worst for the last comer.

**Early Framing.**—Every timber should be of the prescribed scantling, and the roofs and partitions should be framed as early as possible after the contract is signed.

**Keep Woodwork away from Flues.**—The Clerk of Works should see that all ends of timber are kept well away from flues and fireplaces, and that large timbers wherever possible have a bearing of at least 9 in. on the walls.

**Balk Timber or Deals.**—Although the logical interpretation of the ordinary preamble to the specification of the Carpenter is balk timber, deals and battens for a part are nearly always substituted, and if they are of good quality they are preferable. The supply of dry, well-seasoned balk timber is very rare, but deals can always be obtained dry.

Ceiling joists should be specially dry, or

they will show their position through the plaster of the ceilings.

**Trussed Partitions.**—When trussed partitions are specified, the Clerk of Works should see that they really are trussed and bolted up to a slight camber.

**Iron Straps and Bolts.**—See that all these do their work, they are sometimes so loosely fixed as to be almost useless.

**Support Partitions.**—Where ordinary partitions occur running parallel with the joists, see that they do not depend on one joist but are supported on bridging pieces between two joists.

**Keep Plates out of Walls.**—The ends of timber and the plates should be kept out of the walls wherever possible. The Clerk of Works should suggest the carrying of plates on over-sailing courses or iron corbels where practicable. Fires are much more destructive to a carcase in consequence of the burning of embedded wooden plates, and this has induced some Architects to use a line of stout hoop iron in the place of a wooden plate.

**Centering.**—Centering must never be struck before the work is set.

**Scarfig.**—Timbers which are unavoidably jointed over a void should be efficiently scarfed and bolted.

**Notching Down.**—If timbers are described to be notched down on to the bearers which support them, the Clerk of Works should insist upon its being done. It is worthy of observation that there is an inside and an outside to every board and piece of scantling.

**Plugging.**—The plugging should be watched, and not allowed adjoining smoke flues. Beams and woodwork generally should be kept as far from smoke flues and steampipes as can be contrived.

#### JOINER.

**Flooring to be Delivered Early.**—The flooring should be on the site immediately after the signing of the contract, and stacked for seasoning.

See that the flooring boards are laid the right side up, that is, the pith side next the joists.

See that flooring be not laid on the ground floor before the concrete spread beneath is dry. Sometimes floor boards are nailed directly to a bed of concrete ; see that this is quite dry before laying the boards.

**Framings to be put together soon after signing Contract.**—All framings should be prepared and put together at an early stage of the work, glueing up and cleaning off being delayed until just before they are required.

**Laying of Floors.**—The laying of the floors should, if possible, be left until after the plastering is done. Where carpets are likely to be laid, and no carpet fillets are specified, floors should be sprung up to the thresholds, to allow of the opening of the doors. Where skirtings are let into grooves of the floors thorough seasoning of both will be especially necessary.

Some Architects insist upon the delay (as far as practicable) in fixing joinery until after the plastering is done.

**Care of Floors.**—After the floors are laid rooms should not be used as workshops, but each room as it is completed should be cleaned out and the door locked. If fires are in use for the drying of the rooms and the floors are good, the attendant should go about in slippers and take charge of the keys. If the Contractor's men are compelled to pass over finished floors of good quality the Clerk of Works may insist upon their being thickly covered with dry

sawdust, and where there is much traffic with rough boards.

**Removal of Rubbish from Voids.**—See that spaces below ground floors and between ceilings and floorings of upper floors, voids enclosed by framings, &c., are cleared of shavings and rubbish before the laying of the boards.

**Inspection of Joinery in Progress.**—Watch all the joinery while it is being made by calling at the Contractor's workshop. The Clerk of Works can in this way best judge of its quality, and any error of detail referable either to the Architect or the Contractor can be rectified before it has gone far.

**Sap.**—There are various ideas as to the extent to which sapwood shall be excluded. Some specifications say: "No sap whatever will be allowed in finished joiner's work." Observe that if the inspection of joinery is deferred until its delivery at the building it will have been primed and its quality partially concealed.

**Finished Sizes.**—See that all glued joints are cross-tongued, and if finished sizes are specified the Clerk of Works should see that he gets them. The stipulation for finished sizes is frequently evaded, and the amount allowed in



the accounts for the difference is almost always inadequate.

**Sashes and Frames.**—See that sashes are sufficiently weighted. If glazed with plate-glass, lead weights will probably be required.

**Framed and Braced Doors.**—See that the parts are of reasonable proportion; the larger ones and gates should have bottom and middle rails 11 inches wide, stiles, top rails, and braces of batten width.

**Handrails.**—See that all the joints of hand-rails are dowelled and that the core rails are effectually screwed.

**Secret Fixing.**—The Clerk of Works may insist upon highly-finished work and secret fixing when hard woods are used, and that without creating an extra.

**Work for Varnishing.**—By the inspection of joinery during its progress the Clerk of Works may often prevent the use of sandpaper on work intended for varnishing; neither on this or pitch pine should it ever be used; the latter may be finished with a scraper.

**English Oak Joinery.**—Satisfactory production of English oak joinery requires special knowledge, judgment and supervision; the wood

should be thoroughly seasoned and dry, and should be left several months after its preparation at the bench before it is pinned together.

Large frames are best made up in pieces tongued to a deal core. In the case of large gateposts and the like, a hole should be bored through the entire length of each, and this will often preserve it from shaking or cracking.

Large pieces of oak should be hollowed behind if the strength thus lost can be dispensed with, and with similar good results.

The joinery should have double tenons to all framings where the thickness exceeds  $1\frac{1}{4}$  inches.

Bolection mouldings should be rebated, tongued in and glued to the stiles and rails and screwed from the back.

Dados, window backs and similar framings may be preserved by canvas glued all over the concealed surface and afterwards painted with two coats of oil and red lead.

If the fixing of oak joinery be delayed until after the plastering is dry it will be less likely to warp.

**Protection of Joinery.**—See that all joinery is carefully protected from damage, both dirt and bruises, especially the hard wood intended

for polishing, such as handrails, which should have thick brown paper or canvas tied on.

With a little management the fixing of much of the hard wood, as w.-c. or lavatory fittings, bath tops, dadoes, and the like, may be delayed until the building is very near completion, and consequently cleaner.

Risk of damage may be lessened by insistence upon the removal of rubbish and spare materials from the rooms in question.

**Ironmongery.**—If wrought butts are specified the Clerk of Works should insist upon their use. The locks, if not specially described, should be of fair average quality. Much of the exemplary rubbish manufactured may safely be rejected.

He should see that the boxes of spring hinges are securely fixed, and filled with neat's-foot oil or glycerine; at completion, that all ironmongery is screwed, and not nailed; that brass screws are used for brass work, and that every screw hole has a screw.

If a necessary article of ironmongery is not specified, such an article as is customarily used for the class of work may be insisted on.

When three butts are specified for a door, see that each one does its share of the work.

**Joinery badly fixed.**—Good joinery is often spoiled by an incapable fixer: he uses nails too large for the work, which either split the wood or show large holes where nail heads have been driven; he bruises it by violent blows of a large hammer; he fixes it out of the perpendicular; he lays his floors with the joints not parallel with the walls; his grounds are so badly fixed that architraves or skirtings stand at various projections from the face of the plastering. These are but a few of the defects; but much of the difference between good and bad effect is referable to the want of accuracy of measurement and consequent truth of line.

**Master Keys.**—When there are master keys the Clerk of Works should see that they are delivered properly labelled at conclusion of the works.

**Relacquering.**—When old ironmongery is to be relacquered and refixed, decide whether it is worth the expense. It often costs more than a new article of the same kind; if it is worth the doing see that it is properly labelled, or it may be lost.

Delay the fixing of furniture until the painting is completed, and see that it is carefully

refixed so as to avoid injury to the Painter's work.

### PLASTERER.

**Proportions of Material.**—The Clerk of Works should see that the proper proportion of lime and hair is used in all cases.

**Hair.**—Where there are moulded ribs on ceilings an extra proportion of hair must be used, or their weight will bring the ceiling down. Hair should be well beaten; although this is generally specified the stipulation is systematically disregarded.

See that it is free from grease.

**Putty.**—The putty should be run a month or six weeks at the least before it is required for use.

**Thickness of Laths.**—The Clerk of Works should see that the laths are of the proper thickness, that they butt at joints and do not lap, that the joints are frequently broken, and that the early coats of plastering dry thoroughly before succeeding ones are put on.

**Cement and Washed Sand.**—For Portland cement work see that the sand is thoroughly washed, and that the cement is laid out in a

dry place, but exposed to the air, and well turned over for at least a week before use.

**Nails.**—Iron nails beneath Keene's cement will discolour it. Portland cement will not be so affected.

**Keene's Cement.**—See that plasterers do not mix plaster-of-Paris with Keene's or Parian cement.

**Moulds.**—See that the plasterers' zinc moulds for cornices and mouldings agree with the detail drawings.

**Selenitic Lime.**—The use of selenitic lime for lathed work should, if possible, be avoided. Sometimes it is specified to be used for all work except lathed work. The use of two kinds of plastering in one room usually adds considerable trouble and expense.

**Breaking Key of Plastering.**—If floors are not strongly timbered the laying of the floor boards will often break the key of the plastering of ceilings, and they will fall. There is less danger of this if there are ceiling joists.

**Truth of Surface.**—Truth of surface of the finished plastering should be tested with a long straight-edge; this precaution is often disregarded.

**Damage.**—Plastering should be carefully pre-



served from damage, as no amount of making good will ever thoroughly restore damaged work to its original condition.

**Cracks and Blisters.**—The Clerk of Works should watch the making good, and see that it is done with as little cutting away as possible, and that all cracks and blisters which may show themselves after completion be cut out and made good.

All making good should be done in fine plaster-of-Paris, and as much as may be of the necessary cutting away done before plastering.

**Damage.**—Everything movable should be cleared out of the plastered rooms, so that the plastering may be preserved from chips and bruises.

**Gauged Work.**—If plasterers' work is gauged the Clerk of Works should make notes of the proportion of cement or plaster used, and where it is used, the superficial quantity involved may be measured at the adjustment of accounts. Claims are frequently made for the gauging of plastering which are most unreasonable, and after the time which usually elapses before the valuation is made they are very difficult to criticise or to estimate with certainty.

**Geometrical Ceilings.**—See that the centre of the pattern is in the centre of the apartment, and that the whole is parallel to its sides.

**Dubbing.**—Dubbing is another kind of work of which notes should be made; the material used and its thickness varies very much, especially on old walls.

**Cement Paving.**—Cement paving should be carefully watched; the whole of the work to one apartment should be done in one operation, and completed before any part of it has set.

If cement paving is unsatisfactory, there is no efficient way of putting it right but breaking up the whole of the paving in the apartment involved and doing it entirely a second time.

**Tile Paving.**—Tile paving is generally best laid by the men employed by the merchant; they do nothing else, and generally do the work very well. The lines of the pattern should be parallel to the walls, and the centre of the pattern in the centre of the apartment. Defects in these respects are common with the inexperienced fixer.

See that the tiles are carefully unpacked and protected, and carefully protect the finished paving.

## FOUNDER AND SMITH.

**Quality of Castings.**—In this trade the Clerk of Works will be bound to a great extent by the specification, but in the case of cast work he may reject castings for roughness of surface, for want of truth of shape, unequal thickness of metal, or holes filled up with cement.

Metal work can be best judged if delivered unpainted, it can moreover be most effectually scraped and cleaned and the scale removed before painting.

**English Manufacture.**—Iron or steel joists will probably be Belgian if not described to be English. If the latter, the Clerk of Works should see that he gets them, and verify by inspection of the invoices.

**Rivetted Work.**—See that the iron is free of scale, blisters, laminations, and cracked edges; that the rivet holes are exactly opposite to each other; that the rivets fill the holes tightly, and have sound well-formed heads and snaps of uniform size. Direct the removal and renewal of any rivets loose or defective, or with burnt or cracked heads.

**Holes—Threads—Nuts.**—If bolt holes are specified to be drilled the Clerk of Works

should not be content to have them punched. Bolts should have Whitworth threads, and without extra charge. Nuts should be large enough, and should fix properly. Bolts should be screwed up and do their work ; they are sometimes left so loose as to be almost useless.

**Tightening of Bolts.**—Bolts of roof trusses and trussed partitions should be tightened up so that the tie beams slightly camber.

**Careful Supervision of Fixing.**—Iron and steel construction being for the most part used in large buildings and for the support of great weights should be carefully watched.

The bedding of stanchions, columns, and girders should be true, the stanchions and columns quite upright and the girders quite horizontal, bearing to the prescribed extent on the walls, and having pads of felt or lead if so specified. The connections of joists and girders should have their proper complement of bolts and should not depend alone upon the cross strength of bolts ; they should all have a bearing on another member. The Clerk of Works should be on the watch for and prevent careless slinging or raising of heavy weights of this kind in such a way as to injure other work,

and he will thus avoid delays and possible disputes.

**Testing.**—If a sum of money is provided for testing, the Clerk of Works should keep account of all the time, materials, and cartage expended thereon.

**Eaves Gutter.**—See that the eaves gutters are securely bolted at joints and jointed in red lead, and that every hole has a screw protection. See that stoves, enamelled stable fittings and the like are carefully protected until completion; these are often much injured by rust or chipping.

#### GAS FITTER.

**Notes of Size and Course of Pipes.**—This work is often a provision. If so, courses and sizes of the pipes should be noted so that they may be easily measured.

The Clerk of Works should preserve notes of the time and materials used in cutting away and making good and in the fixing of the fittings.

**Access to Pipes.**—In deciding the course of the pipes, that which involves the least making good of plastering should be preferred, if it does not involve the use of much extra material; the facility of getting at the pipes should also be

considered. If the joinery over pipes is not specified to be made movable the Architect's attention should be called to the question. The whole can be fitted to remove with brass screws and cups at a quite small additional expense.

Small doors in the pipe casing may often be used with advantage.

**Defects.**—The Clerk of Works should see that none of the pipes are cracked, that they are carefully jointed, that they all fall towards the meter or boiler, and that men of other trades do not break the joints or knock holes in the pipes.

**Pipes to be put in Early.**—The pipes should be put in at as early a stage of the general work as possible to avoid cutting about.

The pipes and fittings should be thoroughly tested when completed.

**Waste of Gas.**—After gas is laid on, see that it is not wasted by the Contractor. If gas is to be charged to Contractor take notes of its use.

**Gas Fittings.**—See that gas fittings are carefully unpacked and protected.

#### BELLHANGER.

**Pulls.**—There is often a provision for pulls.



An account of the time and materials used in fixing and attendance should be kept.

**Wires and Bells.**—All wires should be easy of access, neither wires nor cranks should touch each other, and the bells should be of varied tones.

If the joinery over the wires is not specified to be made movable the Architect's attention should be called to the fact.

The Clerk of Works should see that bells are fixed as early as possible to save cutting and making good, and that they are tested at completion.

**Electric Bells.**—Electric bells are nearly always a provision. Keep an account of the time and materials used in fixing and attendance. See that battery is charged and all in working order at completion.

#### PLUMBER.

**Weighing Lead.**—The Clerk of Works should see that all lead is of the weight prescribed by weighing pieces as cut. Pieces need not be cut to a special size for the purpose—a small calculation after weighing a piece and measuring its superficial contents will give the weight per foot.

**Points to Observe in Laying.**—Carefully watch the laying, especially the turning up, turning in, and laps. See that all flashings are properly wedged and pointed, and that they have the necessary tacks. Do not permit soldering, but let bossing take its place wherever possible.

**Weight of Pipes—Joints—Connections.**—It is advisable to test the weight of pipes and see that lead and not composition pipe is used. The making of all joints should be carefully watched, and except in very exceptional cases they should be wiped. It is especially important to watch the joints of soil pipes, and to have as few joints as possible to those inside the building. They should be connected with the drains outside and not inside the building. If the drain plan shows a connection with the drain inside the building the Clerk of Works should ask the Architect's permission to take it outside.

Avoid burying the pipes in walls or plastering, and do not let a joint be made in the thickness of a wall.

**Anti-Syphonage.**—If the Clerk of Works has any suggestion to make to the Architect with respect to ventilating or anti-syphonage pipes

he should make it at an early stage of the work, and thereby save expense.

**Wastes and Soil Pipes.**—Especially avoid the connection of wastes with soil pipes.

**Concealed Work.**—It is important to carefully watch the jointing of work which will be concealed, as water-closet apparatus, lavatories, plumbing inside of cisterns, &c., these parts being often ill done.

**Access to Connections.**—Suggest the blocking up of cisterns for access to the connections. A little thought will facilitate the access to traps without extra expense. The insertion of cups and screws where not specified will save much future expense. The labelling of all taps and stop cocks is also very convenient.

**Stop Cocks.**—A stop cock to each system of supply immediately under the cistern and another at the point of entry of main supply into house are generally required. A tap for emptying at the lowest point of main is a useful adjunct.

**List of Stop Cocks.**—In a large system of water supply a list should be made of all the stop cocks.

Their position and uses are generally written

in a tabulated list, framed and glazed, and hung up in one of the domestic offices of the building.

**Access to Pipes.**—All joinery and casings over pipes and the joinery of baths, lavatories, water-closets, &c., should be made movable, and screwed with brass cups and screws. If this is not specified the Clerk of Works should ask the Architect's permission to order it.

**Testing.**—The hot and cold water systems should be thoroughly tested at completion.

**Leaving Clean.**—All boilers and cisterns should be left thoroughly clean, and all spaces under seats of water-closets and enclosures of baths left clear of shavings or other rubbish.

**Wire Covers—Flap Valves.**—The Clerk of Works should see that all the covers specified are put on outlets of eaves gutters, cesspools, and rain-water pipe heads, that all are clear of rubbish, and that all overflows and flap valves are left in working order.

**Use of Apparatus by Workmen.**—See that the workmen do not use the sanitary apparatus or contaminate basements by using them as urinals. It is safest to lock up lavatories, w.c.'s, &c., as soon as they are finished.

**Domestic Hot Water Supply.**—Observe that hot water circulation is often defective from the use of too large a boiler and too large flow and return.

**Steam Pipes.**—The pipe should be “ steam ” ; see that each length is marked “ S.”

**Expansion Pipe.**—Take the expansion pipe to the open air.

**Safety Valve.**—If no safety valve is specified call Architect’s attention to the fact.

**Leave Clean.**—See that the boiler is left clean at completion. See that the hot water is clean.

**Test.**—Test the whole of the pipes and valves at completion.

**Joinery and Floor Boards to Remove.**—All the pipe casing and joinery over pipes to be fitted to remove.

**Dead Water.**—To prevent dead water, lay on to distant draw-offs, with a flow and return pipe in each case.

#### ZINC WORKER.

See that the zinc is of the weight prescribed and that it is fixed without nails or solder.

#### COPPER SMITH.

See that the copper is of the weight prescribed

and that it is fixed as much as possible without soldering.

#### GLAZIER.

**Quality.**—Glass is rarely of the quality prescribed. In sheet glass waviness, which distorts the view, large bubbles, streaks, scratches, or insufficient weight are sufficient reasons for rejection.

**Rebates.**—See that rebates of joinery are clear of sawdust or particles of wood before glazing.

**Plate Glass—Blackening Edges.**—If plate glass is described, the Clerk of Works should insist upon the best glazing quality, and blackening of the edges should be done without extra charge.

**Indiarubber.**—The glazing of door panels, if not specified to be bedded in indiarubber or wash-leather, should be mentioned to the Architect. The expense is very small, and the use of it prevents breakage.

**Lead Lights.**—Where lead lights occur the lead should be stout enough and well cemented. If possible the Clerk of Works should test it with a large syringe. He should check the templates for glass before they are sent away, but disclaim any responsibility for accuracy.



He should also check the Foreman's dimensions for the order for iron casements, and thus preserve him from error.

**Puttying.**—The glazing in wooden sashes should be properly bedded and back puttied.

**Leaving Clean.**—The glass must be left perfect and clean.

#### PAINTER.

**Knotting.**—The Clerk of Works should see that the knotting is well done—it is often nearly useless—and that the proper number of coats of paint are applied.

**Number of Coats.**—Clerks of Works who have adopted the practice of making small marks on the joinery which a coat of paint would efface, have been surprised to find them still visible after the work has ostensibly received another coat.

**Different Colour for each Coat.**—Sometimes the specification prescribes that the paint shall be of a different tint for each coat.

Examine the materials used, especially the white lead and oil, and do not allow too much oil or turpentine to be mixed with the lead. This is often done to save labour.

**Varnish.**—See that you get good varnish. It is advisable to insist that it be brought on the works in cans not previously opened, and if they are not labelled with the maker's name, to see the invoice, and not allow the varnish to be diluted.

**Rubbing Down.**—The Clerk of Works may insist without creating an extra upon the rubbing down of each coat before putting on another, but where this is done to the extent of producing a very specially smooth face an extra will be incurred.

**Stained Work.**—When stained work is varnished special attention to the sizing is important.

Work intended to be stained will require careful protection.

**Painting Iron.**—If concealed ironwork is specified to be painted it is necessary to see that it is done, also that the inside as well as outside of eaves gutters and rain-water pipe heads is painted.

**Tints.**—The Architect should be consulted about the tints of painting before it is commenced.

**Painting Pipes.**—In a large system of pipes

it is very convenient to paint steam, hot, cold, and waste-water pipes each a different and contrasting colour.

**Oiling.**—When oak or teak-work is oiled see that it is very thoroughly rubbed after each coat.

**Sweeping.**—Discourage sweeping or the making of a dust while paint is wet.

#### PAPERHANGER.

**Walls to be Dry.**—See that the walls are thoroughly dry before papering and that the size used is fresh and sweet.

**Stripping.**—If the work is old the old paper should be stripped completely off, and any plastering damaged should be made good with Keene's cement.

**Painting Cracks.**—If walls in which cracks are made good are to be afterwards distempered; the making good should be painted two coats before distempering.

#### CEREMONIES.

**Foundation Stone.**—The laying of the Foundation stone involves the stoppage of the work, and it is usual to pay the men for the time they are interrupted. The Clerk of Works should make notes of such time. Platforms will also

be erected. Take notes of time occupied in erection and taking down; the number of loads of material brought to the building and taken away; a list of boards, planks, poles, barks, &c., which will be charged as use and waste.

**Opening Ceremony.**—Similar items to those in the last paragraph.

**Tarpaulins.**—The hire of tarpaulins is sometimes involved in the foregoing. Note the size, the number, and the time they have been used.

#### ROADS.

**Macadamized Road.**—See that the contour of the road is truly formed, that all roots and stumps are grubbed up, that the gradients are regular, that the material is broken to the stipulated size and is put on of the required thickness, that there be no carting over the road bed after it is formed, and that the whole is efficiently rolled.

**Road of Granite Setts.**—See that the pitchers are of regular and uniform shape, are laid in truly parallel lines, properly breaking joint, to the prescribed contour and sufficiently rammed. Observe the quality of the grouting.

**Tar Paving.**—See that the proper ingredients

are used, and in the prescribed proportions, and all sufficiently boiled.

**Bushing.**—If the ground is very soft or marshy the Architect should be consulted as to the use of brushwood or other expedient of formation.

#### MACHINERY.

**Getting in.**—Large establishments, in which machinery is to be used, involve certain obligations which may be briefly considered. In the event of inadvertence on the part of the Specifier, suggestions by the Clerk of Works may be useful. Often the renewal of steam boilers has not been considered; in such a case the comparatively inexpensive increase in the size of a doorway may prove a great convenience.

To facilitate the bringing in of the original machinery and boilers a specification sometimes gives a clause, as follows:—

“Leave temporary openings in roofs, walls, or floors as may be required or directed for the getting in of cisterns, boilers, machinery, &c., and make good afterwards in all trades.”

**Setting and Fixing.**—If machinery is delivered at the railway station nearest to the building and the general Contractor conveys it to the

building, this will probably be made clear in the Quantities, and the general Contractor will do it; if it is not mentioned or not made clear the Clerk of Works must take notes of the time and cartage.

In most cases the Engineer fixes, but the other trades attend him and supply materials for the fixing and setting.

The work of the trades other than the Mechanical Engineer is often provisional, and in such case the time and materials must be noted.

The supply of water and the attendance in the testing of boilers and machinery, the filling of swimming baths, &c., may be either an item in the bill of Quantities and at Contractor's risk, or it may be provisional, and in the latter case time and material must be noted.

**Protection.**—See that all the bright work is protected from rust until completion (usually by a coat of white lead and tallow) and left clean.

Some specifications stipulate as follows:—

“Set out on outline plans supplied by the Architect at completion of the works the sizes and positions of all machinery and pipes done under the contract.”

See that these plans are made and check them.



### ELECTRIC LIGHTING.

**Company's Rules.**—When the electricity is supplied by a public company, see that their rules are followed; also those of the Board of Trade.

**Testing.**—If testing is provided for in the specification it will only be necessary to see that it is effectually done. If not specified, notes must be taken of the time.

**Attendance.**—If attendance, cutting away, and making good is specified it will only be necessary to see it properly done; if not specified time and material must also be noted.

**Protection.**—See that switch boards, fittings, &c., are carefully protected before and after fixing.

**Wasting the Light.**—After the system is completed see that Contractors do not wantonly use the light.

**Fixing Casings.**—See that all the casings are fixed with brass screws and caps.

**Plans.**—Some Specifications for electric lighting stipulate as follows:—

“Set out on outline plans, supplied by the Architect at the completion of the works, the

sizes and positions of all pipes, wiring, and other work done under the contract, and supply a complete Schedule of the lights and fittings."

See that these plans are made and check them.

#### LIGHTNING CONDUCTORS.

For these a sum is usually provided which includes fixing.

If there is a provisional sum for attendance take notes of time and materials.

Measure the quantity of digging for earth plate and the quantity of coke filled in.

#### VENTILATION AND HEATING.

**Ventilation.**—See that all fans are in working order, that all outlet and inlet shafts are clean, that wooden shafts are air-tight (they should be put together with white lead or thick paint) that all gratings are fixed and properly fixed, that the gear for opening casements is in order.

If there is a provisional sum for attendance, take notes of time and materials.

**Heating.**—The Heating Engineer fixes his own work. If there is a provisional sum for attendance, take notes of time and materials.

If there is a provisional sum for setting heating apparatus or boiler, take notes of time and materials.

If the apparatus, pipes, gratings, &c., are to be delivered at the railway station nearest to the building, take notes of times for unloading from railway truck, loading into carts, carting to the building, unloading and getting in.

See that all gratings are fixed, that movable gratings are carefully fitted, that the pipes all fall towards the boiler, that there are no syphons in them, that the air cocks all work, and the joints of pipes are perfect.

See that all the channels are clean and clear of rubbish.

#### PULLING DOWN.

**Old Materials.**—Sometimes a contract for pulling down provides for the removal of the whole of the old materials, which will be the Contractor's property, and this contract is generally with an independent Contractor (housebreaker); part of this contract may be the shoring of the adjacent buildings, and the Clerk of Works must carefully supervise this;

the old timber is generally sufficient for this, but if it is not, further timber must be supplied; sometimes this Contractor also does the digging.

When the General Contractor pulls down, it is often agreed by the contract that he shall be permitted to use York stone for templates, sound old bricks for the walling, and clear away the remainder; the bill for pulling down is combined with a bill of credits, and it is stipulated (although an approximate weight is stated in the bill) that the lead shall be weighed as it comes from the roofs, and the ultimate weight credited. The Clerk of Works will observe this weighing and make notes of the weight.

Sometimes a building is pulled down by day work, and such materials as are used charged to the builder, principally bricks and stone. The bricks after clearing should be neatly stacked, when the number to be charged may be deduced from the cubic content of the stack.

If broken bricks may be used in the concrete instead of ballast, they should after they are broken be disposed in heaps of shape

convenient for measurement ; see that the whole heap is composed of fragments of brick and exclude old mortar.

**Shoring.**—If a price per foot cube for shoring has been agreed, it will be measured as use and waste, usually at per foot cube as “use and waste of timber in shoring, including all wedges, hoop iron and labour, fixing and removing” ; old timber if it is sound may be used for this.

**Protection of Adjoining Buildings.** — The enclosure of old buildings laid open by the pulling down of a party wall or the like should be watched, and the Clerk of Works should see that it is efficiently done and with as little annoyance to the adjoining owners as may be ; this work in most cases will be specified and included in the bill of Quantities.

**Dust.**—Much annoyance to adjoining owners from dust may be avoided by keeping the work well wetted by a hose while the pulling down proceeds.

**Tarpaulins.**—If the Specification or Quantities makes no mention of Tarpaulins, notes should be made of those used and the period of their use.

**Cartage.**—If the building or parts of it are pulled down by day work, the Clerk of Works should make notes of the number of loads of material or rubbish carted away, and the time, wheeling, basketting, loading, &c., also of any material which is of any value, so that it may be charged to the Contractor.

#### MEASUREMENT OF VARIATIONS.

If the Clerk of Works has kept a proper record of all work, concealed and varied, he can render valuable help in the adjustment of the accounts.

Before the measurement of the variations he should produce a list of items of extra or omission—a list only—for the use of the person who will measure.

During the measurement it is expedient that he attend on the Measurer and produce as it is required all the information he has recorded relating to each item. It is a false economy which dispenses with his service for this purpose.

In the course of the measurement his familiarity with the day accounts will enable him to



say which parts of a particular item have been rendered as day account and which parts will need to be measured.

#### THE EDUCATION AND EXAMINATION OF A CLERK OF WORKS.

If the vocation is fixed upon at an early age, the youth should be taught to write neatly and legibly; should be trained in arithmetic, including vulgar and decimal fractions, and should be taught bookkeeping. He should then be apprenticed to a branch of the building trade, preferably to a joiner or a mason. As a rule the men drawn from these trades, all other things being equal, make the best Foremen, and it is reasonable to suppose that they should make the best Clerk of Works. The neophyte's mechanical teaching being maintained during the day, he should obtain during his evenings a knowledge of theoretical and applied mechanics, and he should also (and this is of paramount importance) learn as much as he can of solid geometry and building construction. These two subjects are now well taught in many parts of the country at moderate rates.

A familiarity with solid geometry, building construction, and mechanics will enable him to make any geometrical drawings that may be required of him.

When he has learned his business as a joiner or mason, acquired proficiency in drawing and a reasonable knowledge of figures, these, if accompanied by moral qualities commensurate, will ensure him a place as Builder's Foreman, and from this position he will derive further training of the very kind he requires.

Such experience, if he duly observes, will teach him the management of his superiors as well as of his subordinates, and will afford him knowledge of men, materials, and workmanship, such as the mere mechanic rarely acquires.

During this period (or before) he should learn to use the level, and he will perforce obtain practice in the setting out of buildings.

If he takes notice of the practice of the Quantity Surveyors with whom he may be brought in contact, and studies the theory besides, he should acquire a reasonable knowledge of measuring. Assiduous attention to his work as Building Foreman will recommend

him to those qualified to judge, and will enable him with but little difficulty to become a Clerk of Works.

He will also probably well understand the feelings and habits of the mechanic, and will consequently possess advantages in dealing with them which a man drawn from a higher grade would miss.

Another type of Clerk of Works originates in the Architect's office. There have been many notable instances of success in this vocation in which the man has never learned the use of tools, and has received his training almost entirely in the office of an Architect.

And in this connection one may compare the training of the Architect with that of the Clerk of Works. Some years ago it was the prevalent opinion that a necessary part of the Architect's training was "two or three years at the bench," as the phrase went, but it was a matter of experience that the "two or three years at the bench" man was not conspicuously superior to him who had never so worked, but had kept his eyes open to seize all his opportunities of obtaining knowledge of his business. It should be remembered that several years are required

to acquire mere manual skill in the use of saw, chisel, and plane.

The same sort of education used to be argued for in the case of the Quantity Surveyor, but the majority of our Quantity Surveyors had no such training. Some of the best have been estimators for builders, and in that capacity, by mere observation of the buildings with which they were concerned, acquired all the skill and knowledge they possess.

Above all, the Clerk of Works should be a good measurer. For this study facilities have increased in recent years. In addition to the various books which are published, there are in London and many provincial towns classes where quantity surveying is efficiently taught, but no class teaching will compare with the course of taking a set of drawings and resolutely preparing the quantities somehow from beginning to end. By no other process will the student so clearly realise the difficulties or make so clear to himself the direction in which his ignorance lies.

Intimately connected with the practice of measurement is the knowledge of materials and prices.

The Clerk of Works, whenever he goes to a new building or a new locality, should by diligent inquiry obtain the prices of local labour and every local material, as sand and ballast per yard, bricks per thousand, stone at the quarry, stone delivered either in block or sawn to sizes, the cost of cartage and railway carriage, and local customs of measurement and valuation. His possession of these items of information will not only prove valuable for future use, but will enable him to assist the Surveyor at the settlement of accounts.

There are other objects of observation which the Clerk of Works may prosecute with signal advantage, such as the time spent by the average workman upon various items of labour, the saving effected by various kinds and arrangements of builder's hoists, the saving on stonework and joinery by the use of machinery, the saving by the use of quarry-worked stone (sometimes no saving), the percentage of waste on stone in the process of conversion, the relative value of a given kind of labour on various stones, particulars of the finish of the surface of various stones, noting whether they are split or sawn, and whether sawn with a wet or dry saw.

The information thus acquired should be carefully preserved in some kind of commonplace book, with careful notes of the source whence the information was obtained and every item dated. Suggestions on the keeping of a commonplace book may be found in Leaning's Building Specifications (Batsford). This practice may be recommended, not only for the information it stores up and makes readily available, but because it fosters a habit of attention and precision of observation. Among the more useful books for the Clerk of Works a few may be mentioned:—

Rivington's Notes on Building Instruction.  
(Longmans.)

Mitchell's Building Construction, Elementary.  
(Batsford.)

Mitchell's Building Construction, Advanced.  
(Batsford.)

Gwilt's Encyclopædia of Architecture.

Hurst's Architectural Surveyor's Handbook.  
(Spon.)

Fletcher's Quantities. (Batsford.)

Leaning's Quantity Surveying. (Spon.)

Leaning's Building Specifications. (Batsford.)

Farrow's Specifications. (Whittaker.)



The kind of examination which the Clerk of Works should be able to pass is fairly illustrated by the requirements of the Government, and the most recently published regulations and examination questions are here appended. By these it will be seen that the standard of general education implied or expected is much beyond that of the ordinary Clerk of Works.

These questions, as for all examinations, may be "crammed" for, but the best advice that can be given to the student is to prepare himself in the most thorough manner that his circumstances will allow. The knowledge of subjects acquired in a hurry is not only easily forgotten, but the valuable collateral effects of the thorough study of a subject are almost entirely lost.

A knowledge of building construction is best acquired by reading a good book on the subject from beginning to end, the student at the same time roughly sketching each illustration, free-hand, as he comes to it. He thus fixes it in his mind more surely than in any other way. At the end of each page or so he should endeavour to recall the facts of that page, and repeat his rough sketches without the book.

After this study the student should make a complete set of working drawings of a building to an eighth or a quarter scale, write the specification, and take out the quantities from them; by such means the student will realise the difficulties and make definite to himself the cases in which he is ignorant.

For a knowledge of the current prices of materials the trade journals are available. The "Timber Trades Journal" will show the price of all kinds of wood. The trade lists of various firms—as makers of sanitary ware, ironmongery, sanitary apparatus, plumber's brass work, &c.—are full of useful knowledge, and the study of them may be recommended.

#### THE GOVERNMENT CLERK OF WORKS.

The office of Clerk of Works under Government has within the last few years been open to public competition.

The Controller of his Majesty's Stationery Office has kindly accorded me permission to print the regulations, examination papers, &c., for an open competition for the situation of Clerk of Works in his Majesty's Office of Works, for March, 1895, for which permission

I take this opportunity of expressing my sincere thanks.

This series of papers may be taken as a fair general type of the kind of examination which may be expected in the future, and the student is advised to go through the whole of them and answer them before he attempts to present himself for examination; he should also assiduously practise those parts in which he finds himself weak. A few general suggestions as to the dealing with examination papers may not be out of place here.

The candidate should read through each paper and decide which of the questions he *cannot* do; he should then begin at the beginning and answer those he *can* do *seriatim*.

Some of the following papers require no comment. They will be easy to any one with an ordinary English education.

After each of the questions where it is deemed necessary ready sources of information are suggested.

The table of marks shows the number of marks awarded for each subject, and their apportionment will show the relative value attached to them by the authorities.

In this series of questions the number of marks accorded for a satisfactory answer to *each* question is not stated. In many sets of published examination questions the maximum number of marks obtainable for each one is mentioned, and the student is thus enabled to select the questions from which he may obtain the most advantage.

The dates of examination are advertised in the building journals and in the *London Gazette*.

There is a set of examination papers for the situation of Clerk of the Works in the Public Works Office, Ireland, in the twenty-sixth report of her Majesty's Civil Service Commissioners, 1882 (p. 604). It will be seen that the English examination differs by the elimination of the sections "Surveying and levelling and valuing land" and "Freehand sketching in outline," and by the addition of "Modern Sanitation."

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# APPENDIX.

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CIVIL SERVICE COMMISSION.

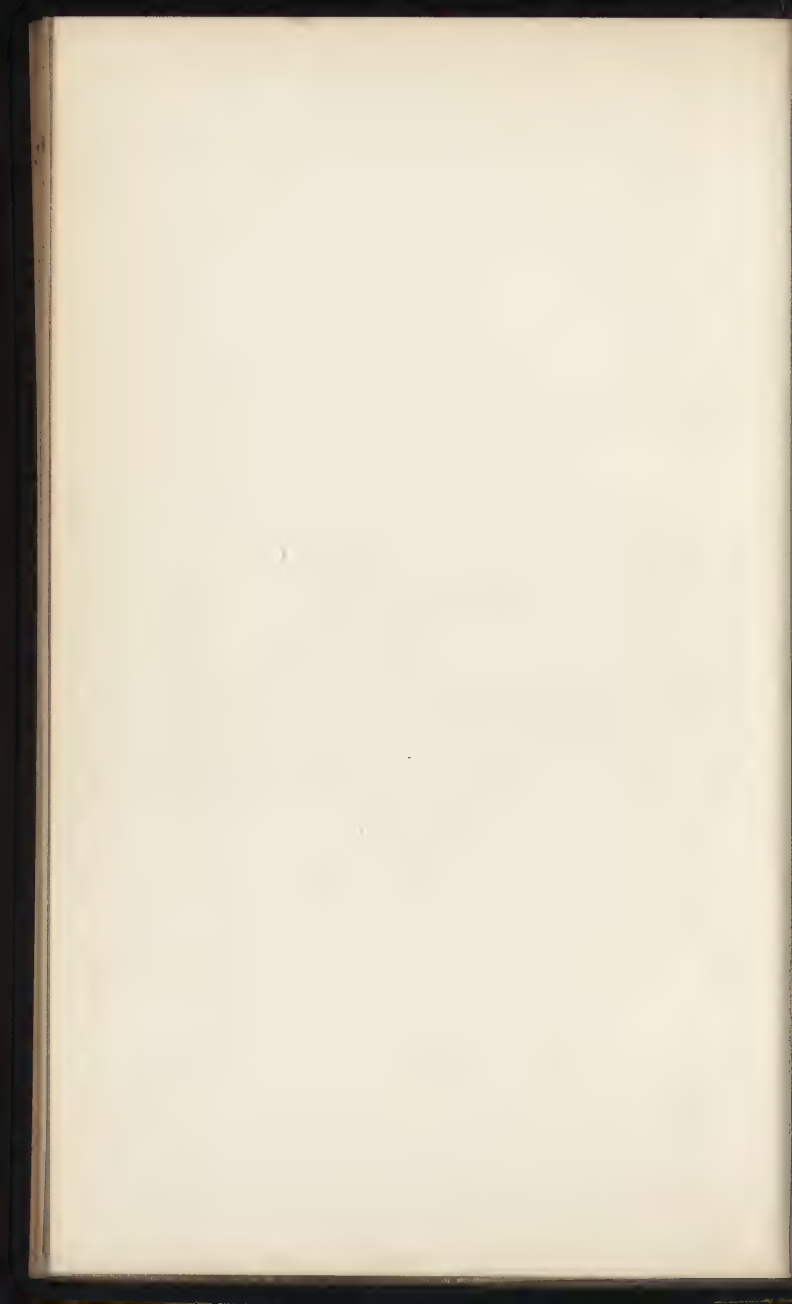
OPEN COMPETITION

FOR THE SITUATION OF

CLERK OF WORKS IN HER MAJESTY'S  
OFFICE OF WORKS,

*March, 1895.*

REGULATIONS, EXAMINATION PAPERS, AND  
TABLE OF MARKS.





## REGULATIONS, &c.

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Special Regulations (Supplementary to the General Regulations issued 8th April, 1872, and amended by subsequent Notices in the *London Gazette*\*) respecting Open Competitive Examinations for the Situation of Clerk of Works in the Office of Her Majesty's Works, &c.

*N.B.—These Regulations are liable to alteration for future Examinations.*

1. The limits of age for this situation are 28 and 35, and Candidates must be of the prescribed age on the first day of the Examination.

2. Candidates must possess the practical experience necessary to qualify them for a situation of this nature. They must have been employed in the superintendence of buildings for at least five years in the capacity of Clerk of Works, and will be required to produce

\* These Regulations are printed on page 135.

satisfactory proof of their efficiency and practical knowledge.

3. The Examination will be in the following subjects, viz.:—

1. Handwriting.
2. Orthography.
3. English Composition.
4. Arithmetic (to Vulgar and Decimal Fractions).
5. Geometrical Drawing.
6. Knowledge of Materials.
7. Designing simple buildings, with specification and estimate, and working drawings of details of carpenters' and masons' work.
8. Taking out quantities from plans, measuring and valuing buildings.
9. Modern Sanitation.

4. Candidates failing in any of the above subjects will not be eligible.

5. Application for permission to attend an Examination must be made at such times and in such manner as the Civil Service Commissioners may appoint.

6. A fee will be required from each Candidate attending the Examination, according to the

scale laid down under the Order in Council of 22nd March, 1879, by notice in the *London Gazette* of 29th April, 1881.\*

Civil Service Commission,  
27th March, 1888.

### NOTICE.

An Open Competitive Examination for the situation of Clerk of Works in the Office of Her Majesty's Works, &c., will be held in London, under the above Regulations, on the 19th March, 1895, and following days.

The number of situations to be filled will be the number vacant at the time of the Examination.

\* \* \* No person will be admitted to the Examination from whom the Secretary, Civil Service Commission, has not received, on or before the 5th March, an application, in the handwriting of the Candidate, on the prescribed form.

\* The fee in the present case is £2. It must be understood that when fees are fixed according to "the annual salary attainable in customary course of promotion without further examination or certificate," the payment of such fees does not give any *claim* to promotion.

The number now vacant is one.

The Order for admission to the Examination will be posted on the 14th March to the address given on the Form of Application. It will contain instructions as to the time and place at which candidates will be required to attend, and as to the manner in which the fee is to be paid.

Civil Service Commission,  
*5th February, 1895.*

NOTE.—The salary attached to the post of a Second Class Clerk of Works is £150, rising by £7 10s. a year to £220, in addition to which each Officer is paid an annual allowance, not exceeding one-sixth of his salary, in lieu of apartments. The salary of the First Class of Clerks of Works, which is filled by promotion from the Second Class, is £250 by £7 10s. to £300, with a residence, or the usual allowance of one-sixth of salary in lieu thereof. The successful Candidate will accept his appointment subject to the express condition that the Staff of the department is liable to re-organisation from time to time, as the interests of the public service may require, and that no claim to compensation on his behalf can be admitted if such re-organisation

shall in effect reduce the number, or alter the conditions of superior appointments in the Department. Promotion to higher grades depends on merit, and on the occurrence of vacancies, but no right of promotion to higher classes or grades is recognised.

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General Regulations (issued 8th April, 1872, and amended by notices in the *London Gazette* of the 24th January, 1873, 21st November, 1873, 16th June, 1874, 5th February, 1875, 9th November, 1875, 20th September, 1878, 12th September, 1879, 27th July, 1880, 23rd November, 1880, 1st August, 1882, 19th May, 1885, and 22nd January, 1886) respecting Open Competitive Examinations for Situations in the Civil Service, included in Schedule A. of the Order in Council of 4th June, 1870.

*N.B.—These Regulations are liable to alterations at any time.*

1. Competitive examinations of Candidates for situations in the different public departments will be held at such times and at such places as may be deemed expedient. Before

every such examination Special Regulations will be issued, in which the particular conditions of the competition will be specified.

2. These examinations will have reference either to the vacancies existing at the time of the examinations respectively, or to the number which may be estimated to occur within any period not exceeding six months after the commencement of the examinations, as may be laid down in Special Regulations, or in any Notice of such examinations published, with the approval of the Lords of the Treasury, in the *London Gazette*.

3. These examinations are open, under such general restrictions as may be laid down, to all natural-born subjects of Her Majesty, being of the requisite age, health, and character. The undermentioned restrictions are at present in force :

(i.) Persons actually serving in the Army and Navy, and members of the Royal Irish Constabulary of less than five years' service are ineligible.

(ii.) The following classes of persons are eligible under certain conditions only, that is to say :—



- (a) Persons holding situations in the Civil Service.
- (b) Members of the Royal Irish Constabulary, of more than five years' service.
- (c) Apprentices and Engineer students in Her Majesty's Dockyards.
- (d) Persons who have been trained in Normal Schools at the public expense.
- (e) Persons who have been trained in the Laboratory of the Inland Revenue Department.

Persons comprised in the classes (a), (b), (c) must produce to the Civil Service Commissioners the written permission\* of the authorities of their department to attend the examination, dated before the commencement of the competition.

Persons comprised in class (d) will not be qualified to receive appointments until the consent of the Committee of Council on Education, Great Britain, or the Commissioners of National Education,

\* It is desirable that this permission should be produced at least one week before the date of the competition.

Ireland, as the case may be, given in conformity with rules sanctioned by the Lords of the Treasury, has been notified to the Civil Service Commissioners.

Persons comprised in class (e) will not be qualified for appointment until the consent of the Board of Inland Revenue given with the like sanction, has been notified to the Civil Service Commissioners.

4. In reckoning age for competition the following allowances will be made, viz., (1) members of the Military and Naval services (whether commissioned or non-commissioned) may deduct from their actual age any time during which they have served towards pension; (2) persons who have served for two full consecutive years (a) in any Civil situation to which they were admitted with the Certificate of the Civil Service Commissioners, (b) in the Royal Irish Constabulary, or (c) as Registered Copyists in connection with the Civil Service, may deduct from their actual age any time not exceeding five years which they may have spent in such service.

5. If at any examination two or more situations, whether in the same or in different Departments, shall be offered for competition, the successful Candidates will be permitted (unless otherwise stated in Special Regulations) to choose in their order as determined by the competitive examination among the situations offered for competition; provided that they be duly qualified according to the special rules prescribed under Clause IV. of Her Majesty's Order in Council of 4th June, 1870, for the particular situations to which they may severally be assigned. If there be a vacant situation for which no one of the successful Candidates is duly qualified, the Civil Service Commissioners may offer it to the highest Candidate on the list whom they may deem duly qualified, or to the Candidate highest at the time on the list, subject to his passing a qualifying examination within such period as they may determine; or they may reserve it to be filled by means of a subsequent open competition, or otherwise, as they may see fit, in accordance with the Order in Council of 4th June, 1870.

Civil Service Commission, London, S.W.

## TIME TABLE.

Time of Examination.		Subjects of Examination.
Tuesday, 19th March	10 A.M. to 12 noon ...	English Composition.
	12.5 P.M. to 12.25 P.M. ...	Copying.
	12.30 P.M. ...	Dictation.
	2 P.M. to 4 P.M. ...	Arithmetic (1).
	4.5 P.M. to 5.35 P.M. ...	Arithmetic (2).
Wednesday, 20th March	10 A.M. to 12.30 P.M. ...	Geometrical Drawing.
	12.35 P.M. to 1.5 P.M. ...	Addition.
	2 P.M. to 5 P.M. ...	Sanitation.
Thursday, 21st March	10 A.M. to 1 P.M. ...	Taking out Quantities.
	2 P.M. to 5 P.M. ...	Knowledge of Materials.
Friday, 22nd March	10 A.M. to 1 P.M. ...	{ Designing Buildings.
	2 P.M. to 6 P.M. ...	

No drawing materials beyond Drawing Paper, Drawing Boards, T-Squares, Palettes, Indian Ink, and Colours will be supplied by the Commissioners. Candidates must bring with them any other instruments or materials which they may wish to use.

If from any cause it should be found impossible to adhere to the precise times set down in this Time Table, care will be taken that the Candidates are allowed the full time for each paper.

*N.B.—Candidates failing to attend punctually will forfeit their right to be examined.*

## NOTICES.

1. Candidates must, before proceeding to the Examination Rooms, leave, in a room provided for that purpose, their hats, overcoats, umbrellas, and any books or papers which they may have brought with them.
2. No Candidate may quit the Examination Room until the expiration of half an hour from the time fixed for the commencement of the paper on which he is engaged.
3. No Candidate who has left the Examination Room during the hours assigned to paper work may return to the paper which he has quitted, without special permission, obtained before he leaves the room. In such cases, the Commissioners will decide whether marks can be allotted.
4. Perfect silence must be preserved in the Examination Room ; and any Candidate guilty of disorderly or improper conduct in or about the Room will be liable to exclusion from the Examination.
5. Any Candidate detected in the Examination Room in the possession of a book, manuscript, or other article from which he might

derive irregular assistance, or in copying from the papers of any other Candidate, or in permitting his own papers to be copied, or in giving or attempting to give, or in obtaining or attempting to obtain assistance of any description, will be thereby disqualified, and will not be admitted to any subsequent Examination held under the directions of the Civil Service Commissioners.

6. Each Candidate will be designated by the number assigned to him on the Order for Examination, and he must write this Number (not his Name) on every book or separate sheet of paper which he sends in.
7. Any Candidate who is dissatisfied with the pens, ink, or paper supplied to him is requested to apply to the Superintendent of the Examination Room; but those who prefer any particular kind of pen are recommended to bring it with them.



## EXAMINATION PAPERS.

## COPYING.

*Copy, on the form supplied, in your best handwriting, as much as you can of the following, in the prescribed time. It is desirable to copy the whole of the passage on the one page, but you may, if necessary, use the other side. Importance is attached to the clear formation of figures.*

## RHODES.

*Extract from Consular Report on Commerce of Rhodes during the Years 1885-89.*

LIST of the Shipping at the Port of Rhodes during the Years 1885-89.

Year.	Number.			Tonnage.		
	Steamers.	Sailing Ships.	Total.	Steamers.	Sailing Ships.	Total.
1885 ...	379	1,805	2,184	244,316	18,418	262,734
1886 ...	407	2,480	2,887	288,706	22,135	310,841
1887 ...	378	2,470	2,848	268,717	21,640	290,357
1888 ...	384	2,236	2,620	179,001	20,274	199,275
1889 ...	361	2,254	2,615	155,703	18,961	174,664
Total	1,909	11,245	13,154	1,136,443	101,428	1,237,871

Of these steamers 843 were under the British flag; tonnage 177,569.

During the past few years the trade of Rhodes has been steadily declining, and, although in some branches a slight improvement may be noticed, the state of commerce during the year 1888 hardly justifies the hope that this decline has reached its lowest point. Various causes have contributed to bring about this state of affairs, but one of the most obvious signs of this decline may be mentioned here, viz., the great reduction in the number of large steamers calling at this port.

Within the last two years the French steamship company of the Messageries Maritimes has withdrawn its agency at Rhodes, and its steamers, which used to touch at this port once a week, no longer call here. The Russian company discontinued sending its steamers to Rhodes at the time of the Russo-Turkish War, and when at the close of the war this service was reopened, Rhodes was omitted from the list of ports visited by those steamers.

#### DICTATION.

There they stand, the ranks of the faithful, as they have stood yearly for centuries in the last week of their great festival. As the

trumpet notes of each recited verse die away among the arches of the Great Mosque, every man raises his hands above his head, then falls upon his knees, prostrates himself, and rises again, renewing the act of homage three times with the precision of a military evolution. At each prostration, performed exactly and simultaneously by that countless multitude, the air is filled with the tremendous roar of muffled rhythmical thunder, in which no voice is heard, but only the motion of ten thousand human bodies, swaying, bending, and kneeling in unison. Nor is the sound alone impressive. From the vaulted roof, from the galleries, from the dome itself, are hung hundreds of gigantic chandeliers, each having concentric rings of lighted lamps, suspended a few feet above the heads of the worshippers. Seen from the great height of the gallery, these thousands of lights do not dazzle nor hide the multitude below, which seem too great to be hidden, as the heavens are not hid by the stars; but the soft illumination fills every corner and angle of the immense building, and lest any detail of the architecture and splendid mosaic should escape the light, rows of little lamps are kindled along

the cornices of the galleries and roof, filling up the interstices of darkness. This whole flood of glorious illumination descends to the floor of the nave, and envelops the ranks of worshippers in their white and green raiment. There is something mystic and awe-inspiring in the sight, the sound, the whole condition of this strange worship. A man looks down upon the serried army of believers, and, whatever be his own belief, he cannot but feel an unwonted thrill of admiration, a tremor of awe, a quiver of dread, at the grand solemnity of this unanimous worship of the unseen.

#### SUBJECTS FOR ENGLISH COMPOSITION.

*You should pay attention to your spelling, punctuation, grammar, and style. Your Composition should fill at least two pages, but it will be valued according to the quality rather than the quantity.*

Write an essay on *one* of the following subjects :—

1. Electricity as a motor power ;

*Or,*

2. The Paving of the Streets ;

*Or,*

3. The Frost and the Building Trades.

“English Composition,” Nichol (Macmillan); “Stops, or how to punctuate,” Allardyce (Fisher Unwin); “How to write clearly,” Abbott (Seeley).

### ARITHMETIC. (1.)

[N.B.—You are requested to put the number to each question, and to send up the working as well as the answers. No extra marks will be given for completing your answers in less than the time allowed.]

1. Multiply 1 mile 3 fur. 2 p. 1 yard by 53.
2. Divide 30 lbs. 3 oz. 10 dwt. 9 grs. by 21.
3. In 7,313 lbs. how many tons, cwt., qrs.?
4. Reduce 1 qr. 1 peck and 3 qts. to pints.
5. What is the greatest number that will divide 1035 and 1665 without remainders?
6. What is the lowest number divisible exactly by 33, 22, 55, and 30?
7. Reduce  $\frac{3\frac{4}{6}\frac{6}{3}\frac{5}{5}}$  to its lowest terms.
8. Add  $5\frac{1}{1}\frac{3}{8}$  to  $8\frac{2}{4}\frac{3}{5}$ .
9. Subtract  $4\frac{1}{3}\frac{6}{5}$  from  $9\frac{1}{2}\frac{1}{5}$ .
10. Multiply  $2\frac{5}{2}\frac{3}{3}$  by  $1\frac{4}{5}\frac{5}{1}$ .

11. Divide  $\frac{1\frac{2}{5}}{\frac{2}{5}}$  by  $7\frac{1}{5}$ .
12. Add together 46·843, ·00591, ·63, and 20.
13. Subtract 5·9027 from 8·432.
14. Multiply 12·35 by ·0064.
15. Divide 1·3384 by 239.
16. Express  $\frac{2\frac{1}{2}}{1\frac{1}{2}}$  as a decimal.
17. Express 1 day 2 hours 29 min. as the fraction of 5 days 12 hours 25 min.
18. Find the value, in pounds, shillings, and pence of ·625 of 21*l*.
19. Find the cost of 291 articles at 13*s*. 10½*d*. each.
20. What rent must be paid for 3*a*. 2*r*. 11*p*. at 4*l*. 10*s*. per acre?
21. How long will 34 men take to build a wall that 17 men can finish in 16 days?
22. With wheat at 28*s*. per quarter, 6 men can be fed for 15 days at a certain cost. How long can 7 men be fed for the same cost, when wheat is 30*s*. per quarter?
23. Express 2½ per cent. of 5 tons 5 cwt., in cwt., qrs., and lbs.
24. In measuring a distance of 155 miles, an error of 10 miles 6 furlongs 32 poles is found. How much per cent. does this error amount to?



25. How much will it cost to paper a room 18 ft. long,  $13\frac{1}{2}$  ft. wide, and 10 ft. high, at one shilling per sq. yard?

The whole of these questions must be answered. They are a test of general accuracy.

ARITHMETIC. (2.)

*[Arithmetical methods of solution are required.  
All working must be clearly shown.]*

1. What is a *prime* number? Give one example to show that two numbers which are *prime* to each other, are not necessarily *prime* numbers.

Resolve 17,424 into prime factors, and hence (or otherwise) find the side of a square field which contains 3 acres 2,904 square yards, and reduce it to the decimal of a mile.

2. Divide 21*l.* 7*s.* 6*d.* between a man, a woman, and a boy, so that for every 5*s.* the man gets, the boy may get 3*s.*, and for every 5*s.* the woman gets, the boy may get 3*s.* 9*d.*
3. The edges of a carpet in a room 25 ft. 6 in. long and 18 ft. 4 in. broad, are 1 ft. 3 in. from the walls. Find the area of the carpet, in yards, feet, and inches.

4. Find the total weight in three boxes which respectively contain  $(\frac{3}{4} \times 5\frac{7}{8})$  quarters,  $(\frac{3}{4} + 5 \times \frac{7}{8})$  pounds, and  $(\frac{3}{4} \times 5 + \frac{7}{8})$  ounces.
5. If it takes 2 days 1 hour to do 60 miles walking 7 hours each day, how long will it take to do 42 miles walking one hour more each day, but half a mile an hour less ;
6. A person bought the materials of an old house for £120 upon condition that they should be removed within 12 days under a penalty of £1 a day for every day over the 12 days. He paid £3 10s. a day for labour, and having sold the materials for £214 10s., he found that he had made a profit of £30. How many days did he take to remove the materials ?

These questions are a test of the knowledge of the application of the ordinary rules of arithmetic.

“Arithmetic,” Hamblin Smith (Rivington).

## ADDITION.

N.B.—*You had better occupy the whole time allowed. No additional marks will be given for rapidity.*

*Do not copy out the Sums.*

Add these up, placing the Answers in the spaces indicated.

£	s.	d.	£	s.	d.	£	s.	d.
718329	16	7	960387	4	5	425208	7	6
209674	19	11	787639	7	7	98290	2	10
541263	9	5	3976	15	8	302475	11	6
69840	3	7	32410	3	5	89768	12	11
23276	5	9	347786	11	10	267873	13	2
891174	2	10	93257	13	11	373041	2	7
538097	1	2	99374	5	7	189603	2	5
358756	3	7	7624	6	2	658	16	11
7924	13	5	677095	6	9	815975	16	11
465983	17	11	232087	9	7	769873	13	7
361211	6	7	984917	10	8	24761	18	4
95016	18	2	29200	7	9	74573	2	4
23297	12	5	748639	7	5	1983	19	11
631902	8	6	642935	8	1	22896	10	10
90574	2	1	36197	11	7	318019	3	8
31847	1	2	828	17	5	744032	8	6
34232	1	11	17296	13	7	9234	19	10
476239	15	7	381397	7	1	621140	15	6
18759	13	11	41877	19	3	147732	6	2

Before casting the columns, point the thousands. After casting each column from bottom to top, check it by casting it from top to bottom.

Add these up, placing the Answers in the spaces indicated.

£	s.	d.	£	s.	d.	£	s.	d.
938267	4	10	74321	18	9	740986	13	4
74321	18	9	326408	13	10	47983	19	3
16391	1	4	424368	9	8	17218	9	6
76899	13	7	29215	9	5	810732	17	1
514861	6	9	897	15	3	845432	19	10
11835	0	3	106747	18	3	166197	11	7
23109	19	10	302525	13	5	94636	1	1
274032	12	1	376514	10	5	23109	19	10
528636	4	11	675940	18	2	129374	5	7
6679	14	5	42361	8	9	810327	4	4
97243	17	11	432799	11	8	239763	2	1
39642	5	2	112935	8	1	718	7	7
691040	3	7	95483	17	10	714961	13	11
153748	2	9	93198	10	8	20242	0	7
391	1	4	310397	8	7	141263	9	5
765491	9	5	32752	15	3	612356	1	2
673159	0	1	228416	9	10	708416	19	7
31140	15	6	299653	1	8	649603	2	5
310397	8	7	310397	8	7	34728	12	6

Before casting the columns, point the thousands. After casting each column from bottom to top, check it by casting it from top to bottom.

Add these *across*, placing the Totals in the spaces indicated.

45687	29847	12788	5417	24293	12120	5212	488	2543	2502
43958	10195	8197	39908	12190	15670	7501	19077	12424	2657
8963	9572	18919	1350	3908	4096	40914	6771	3285	3535
80631	21555	22279	2779	9665	345	9235	8169	2187	8520
58392	10075	9735	36567	6105	21944	9026	5725	31692	3459
8969	17629	4275	31932	4718	504	6304	12980	1488	2469
17282	18090	742	9623	36095	862	4425	7280	4245	4889
9135	19425	13218	3657	8936	4005	19482	8890	615	1689
6653	7639	34209	3891	12815	3503	903	16245	913	1314
14955	31457	6495	7000	9687	22916	2165	6252	862	9451
6469	25783	14175	18215	284	11909	9720	3038	394	2074
13668	27770	7624	25839	1033	3710	15587	2604	7527	329
7632	3205	220	3001	5184	7161	6291	1940	290	3640
2152	9228	830	969	16075	1070	713	3234	491	535
19487	14245	5018	4323	7790	925	856	2072	7316	346
987	5481	2076	930	2406	386	7495	769	486	845
1096	819	10463	3105	2573	673	74	197	320	1405
13721	2356	7803	6537	20051	647	7079	210	770	892

Point the thousands. Cast from left to right, and then reverse the process as a check.

## GEOMETRICAL DRAWING.

*[The figures must be neatly and accurately drawn, and the lines must be clean and fine ; superfluous portions are to be erased and lines of construction dotted. Special stress is laid on neatness and accuracy. Figures to be inked in as far as time allows.]*

1. Construct a regular octagon of  $1\frac{1}{4}$  inch side and reduce it to a triangle of equal area.
2. Describe an equilateral triangle of  $1\frac{3}{4}$  inch side. Through each vertex draw lines parallel to the opposite sides, thus forming a second triangle. In the larger triangle inscribe three equal circles each touching two sides and each other.
3. Draw a line OP  $2\frac{3}{4}$  inches long. Through O draw OQ perpendicular to OP and  $1\frac{1}{2}$  inch long. On PQ describe a triangle PQR having a right angle at R, and equal sides PR, QR ; R and O to be taken on opposite sides of PQ.

Describe a circle passing through OPQ.

4. Construct a triangle whose three sides are :  
 $AB = 3\frac{1}{2}$  inches ;  $BC = 2\frac{3}{4}$  inches ;  $CA = 2$  inches. Take a point D in AB where



$AD = 2\frac{1}{2}$  inches, and through D draw a line bisecting the triangle.

5. Construct a scale of 2 miles to the inch, showing miles and furlongs, and give the representative fraction.
6. Draw a line  $6\frac{3}{4}$  inches long representing 60 miles, and divide it into 6 equal parts of 10 miles each. On it construct a scale to read furlongs, and mark off a length of 27 miles 5 furlongs.

Gill's "Second Grade Plane Geometry," Kempster.

#### KNOWLEDGE OF MATERIALS.

*[Only seven questions to be answered.]*

1. What are the various kinds of stone in general use in England. When and where should each be used?
2. What are the best methods of working each of the above stones? Describe the tools used, and the various ways of finishing the stone.
3. Describe the bricks used generally, and the advantages and disadvantages of each kind.
4. State shortly the process of manufacture of stock bricks and common wire-cut red bricks.

5. Write a short specification of the materials you would use for (a) lime concrete, (b) cement concrete.
6. In what sizes is timber commonly imported? Do you know any special characteristics of the timber sent from (a) Memel, (b) Dantzic, (c) St. Petersburg, (d) Christiana?
7. From what place does pitch pine come, and under what circumstances should it be used?
8. Where would you use hard woods, and what kind do you prefer?
9. What tests would you impose for wrought iron, cast iron, and Portland cement?  
    "Building Construction" (Vol. 3), Longmans.  
    "Building Materials," G. A. T. Middleton.

DESIGNING SIMPLE BUILDINGS, WITH SPECIFICATION AND ESTIMATE.

1. Designs are required for a Free Library and Reading Room for a small town. The following accommodation required:—On ground floor, general and ladies' reading rooms, library, magazine room, and librarian's room. On upper floor, care-

taker's rooms and book store. The site is at the corner of the main street and a side road, with frontage to the main street of 50' 0", depth 100' 0".

Give ground plan, front elevation, and section, to a scale of 8 feet to an inch, marking on plan all the dimensions.

NOTE.—*The whole of the site need not necessarily be utilized.*

2. Give the heads of the Specification for the workmanship and the materials you propose to use in the building of the above.

Leaning's "Building Specifications," Batsford. Farrow's "Specifications."

3. Describe the methods of arriving at the cost of a building. Give an approximate estimate of the above building by one of these methods, with details of your calculation.

Leaning's "Quantity Surveying," Spon. Fletcher's "Quantities," Batsford.

#### WORKING DRAWINGS OF DETAILS OF CARPENTERS' AND MASONS' WORK.

1. Draw to a scale of 1 inch to the foot, a section through the upper portion of a shop front with an 18" wall over, and having a

stone entablature 2' 6" in height, showing the construction about the first floor level.

2. A room 26' 6"  $\times$  16' 6" has to be covered with a lead flat. It is desired to have a battlemented parapet all round it.

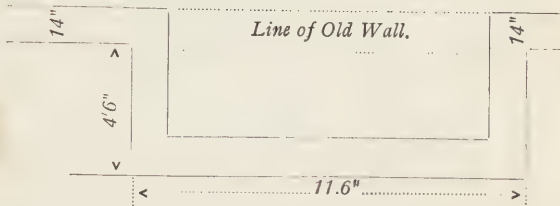
Give plan and section scale of  $\frac{1}{2}$ " to the foot, showing the construction, and figure the scantlings.

3. Draw to a scale of  $\frac{1}{2}$ " to the foot, the elevation of one of the frames of a gantry to support a "traveller." The gantry to be 25' 0" high and the distance between the frames to be 23' 0".

Seddon's "Builders' Work," Longmans. Hurst's "Tredgold's Carpentry," Spon.

4. It is desired to add a stone mullioned window of the size shown on sketch to a drawing room.

Draw to a scale of  $\frac{1}{2}$ " to the foot, plan and section.



5. Explain and illustrate "transverse rib," "template," "sunk splay," "vermiculated work," "random rubble," "pierre perdu," "frieze," "long and short work."
6. Draw to a scale of  $\frac{1}{2}$ " to the foot, plan and section of a geometrical circular stone staircase to be contained in a circular brick shaft of 7 feet internal diameter. Height, floor to floor, 11' 6".
7. Give any two details of the above staircase to illustrate the construction.

"Building Construction" (Vols. 1 and 2), Longmans. Mitchell's "Building Construction," Elementary and Advanced, Batsford.

#### TAKING OUT QUANTITIES FROM PLANS, MEASURING AND VALUING BUILDINGS.

Take off, abstract, and write out fair-priced bills of quantities for bricklayers', masons', carpenters', plasterers', and plumbers' work in the ADDITION BUILDING shown on the accompanying lithographed drawing to which the following epitomised specification relates.

*Excavator.*—Excavate for basement to the widths and depths shown on drawing.

The concrete to be composed of 6 parts of clean Thames ballast to 1 of Portland cement.

*Bricklayer.*—The bricks to be the best hard-burnt picked stocks. To be laid in cement mortar composed of 1 part Portland cement to 4 parts of clean river sand.

The windows and openings to have arches in approved red rubbers.

The damp course, both vertical and horizontal, to be of  $\frac{3}{4}$ " Val de Travers. The vertical to be an average of 2" above the ground level.

*Mason.*—The hearths to be 2" rubbed York stone for back hearths:  $2\frac{1}{2}$ " thick for front hearths.

*Carpenter.*—The lintels to be 1" in thickness for every foot of opening. The lead flat to have 9"  $\times$  3" joists and  $4\frac{1}{2}$ "  $\times$  3" wall plates, and be covered with 1" sawn boarding.

*Joiner.*—This trade is to be omitted.

*Plasterer.*—All angles of walls to be finished in Keene's cement.

*Plumber.*—All lead laid in horizontal positions to be 6 lb. lead, and all lead in vertical positions to be 5 lb. lead.

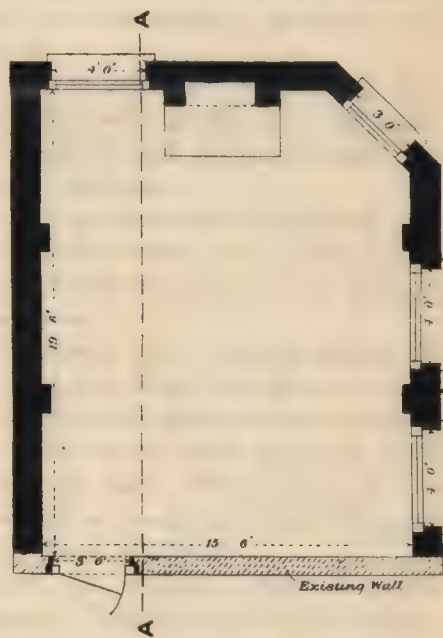
Leaning's "Quantity Surveying," Spon. Fletcher's "Quantities," Batsford. Re.'s "How to Estimate," Batsford Stephenson's "Estimating," Batsford.



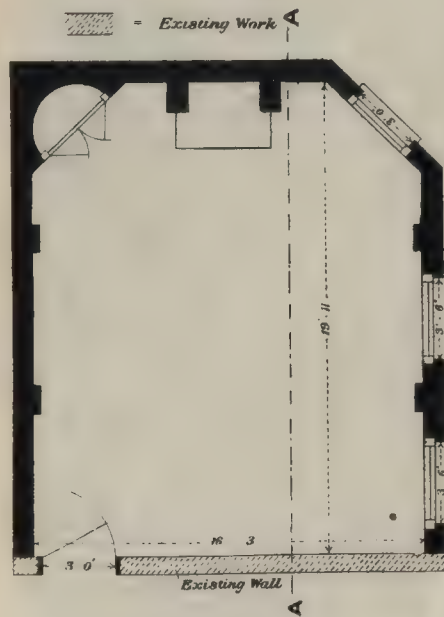
ADDITION BUILDING.

— = New Work

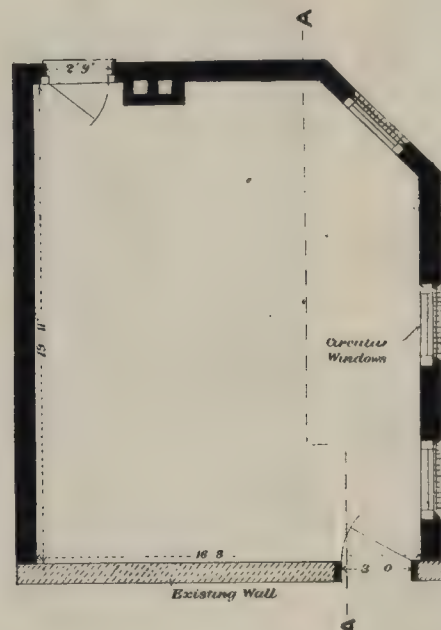
▨ = Existing Work



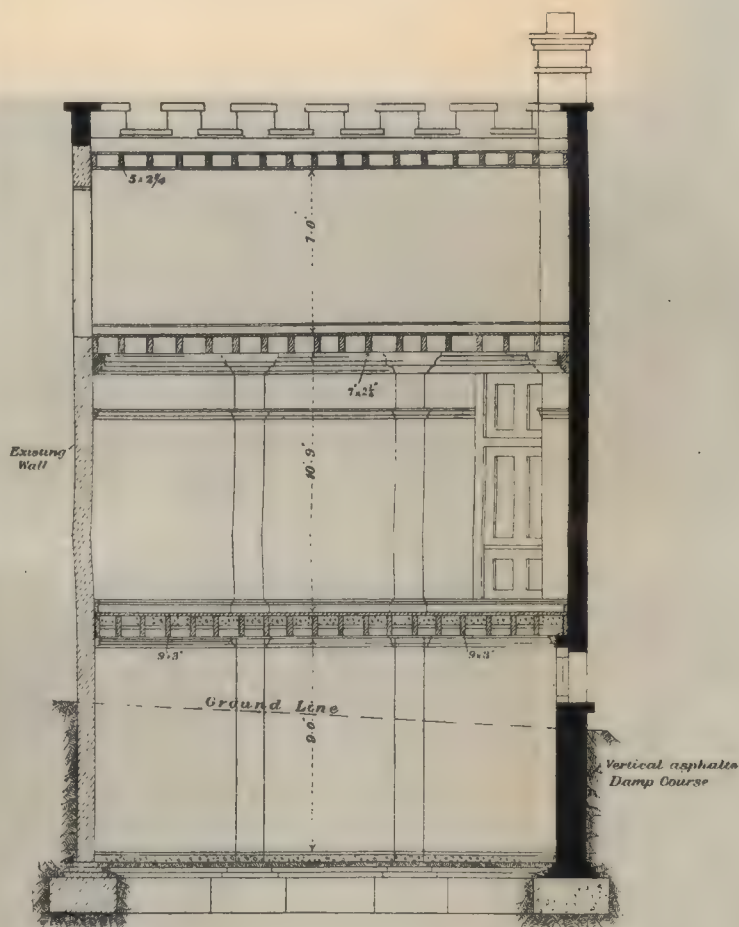
BASEMENT PLAN.



GROUND FLOOR PLAN.



ATTIC PLAN



SECTION ON LINE A.A.

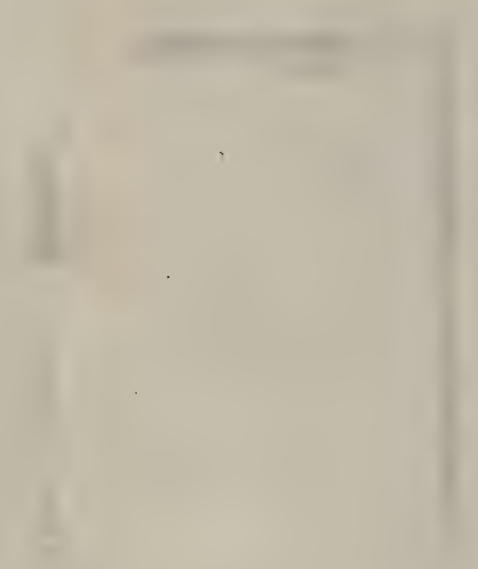


EAST ELEVATION.

SCALE OF FEET.







## MODERN SANITATION.

*[Only six questions to be answered.]*

1. Sketch and describe the w.c. apparatus you would specify for (a), the best class of house; (b), an artisan's dwelling; (c), barracks.
2. Show the connection, with dimensions, to a sewer from each of the above apparatus when fixed on both the ground and first floors of a building.
3. How would you connect a kitchen sink, and a bath and lavatory, to a drain pipe? Specify exactly the materials to be used in each case.
4. Describe shortly with a figured sketch the best apparatus to take the place of a w.c. in a country house without using any water.
5. What are the various drain pipes and joints in common use? What traps do you prefer, and how would you make and test a drain under a building?
6. What are the common causes of smoky chimneys? Which cowls do you prefer, and why?
7. How would you disinfect bedding, and an

infected dwelling? In the latter case, what work would be necessary to render the house habitable?

8. How would you deal with frozen soil pipes and water pipes? Can you suggest the best means of arranging these pipes to avoid freezing?

Hellyer's "Plumbing and Sanitary Work," Batsford.  
Middleton's "Drainage of Town and Country Houses,"  
Batsford. The Trade Lists of Doulton, Bolding, and  
Winser.

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## TABLE OF MARKS.

TABLE showing the RESULTS of an OPEN COMPETITIVE EXAMINATION, held on the 19th and following days of March, in the year 1895, of CANDIDATES for 1 SITUATION AS CLERK OF WORKS IN THE OFFICE OF HER MAJESTY'S WORKS.

Number in Order of Merit.	Number in Examination.	Name.	Arithmetic.										Total.
			Maximum	200	100	100	Handwriting.	English Composition.	Geometrical Drawing.	Knowledge of Materials.	Designing simple Buildings with Specifications, &c., and Working Drawings of details of Carpenter Work, &c.	Taking out Quantities from Plans, Measuring, and Valuing Buildings.	Modern Sanitation.
1	108	Stears, E. D. ...	129	80	63	45	74	163	270	105	236	1165	
—	102	... ..	135	100	77	77	73	134	244	[0]	216	—	
—	107	... ..	91	[0]	51	55	83	113	[0]	[0]	160	—	

THE FOLLOWING CANDIDATES FAILED TO QUALIFY IN ONE OR MORE OF THE PRESCRIBED SUBJECTS.  
 THE CYPHERS ENCLOSED WITHIN BRACKETS THUS [0] INDICATE THE SUBJECTS IN WHICH THEY FAILED TO QUALIFY.

CIVIL SERVICE COMMISSION, 4th April, 1895.

CLERKS OF WORKS TO PUBLIC BUILDING  
DEPARTMENTS.

**Printed Regulations.**—Some of the public bodies which employ Clerks of Works have printed regulations for their guidance. These vary considerably. Some of the ordinary stipulations are as follows :—

The form used by the School Board for London is a very reasonable one (see page 168) and may possibly prove useful; other reasonable clauses are as follows :—

“To check the setting out of all work and assist the foreman in every way to avoid errors.”

“To make notes of all authorized variations, and where necessary to make figured sketches thereof.”

“In the case of variations ordered as day work to keep accounts of time and material and in connection with all variations to note the state of the work affected at the time the order is given.”

“To enter in his diary daily his own hours of attendance and the several matters upon which he may be engaged.”

“To keep press copies in a book, to be provided by and to remain the property of the department, of all letters and reports he may write.”

“Not to absent himself from the works without permission, but in case of unavoidable absence to report it without delay.”

“In case of illness for more than two days a medical certificate shall be delivered to the Architect on the morning of the third day.”

“The engagement shall be subject to termination by a week's notice on either side.”

“Except under exceptional circumstances to be determined by the Architect not to be paid for overtime which the necessities of the works may involve.”

“The wages of the Clerk of Works shall be paid monthly.”

“The Clerk of Works shall not express an opinion on samples until they have been submitted to the Architect.”

“To report to the Architect the brands and ports of shipment of timber and deals. In the event of the Clerk of Works being employed to supervise several buildings, the Clerk of Works shall be allowed second class railway



fares and car and omnibus fares in and around London, but not cabs."

**Holidays**—Except general holidays are not often given, although when a building takes several years to build they should be. One public department adopts the following arrangement :—

"Clerks of Works who have served continuously for two years shall be allowed three weeks holiday during the summer recess, and other Clerks of Works two weeks holiday provided that they have been employed continuously for six months and that their employment is in the opinion of the Architect likely to extend to twelve months."

**Payment during Absence.**—This must depend very much upon circumstances. Often nothing is paid during absence. One public department adopts the following regulations:—

"Clerks of Works may in case of illness not attributable to intemperance or misconduct be allowed half pay while absent if they have been in the department's service under six months, if over that period full pay may be granted for a limited period."

Probably in the majority of cases full pay for

the period arranged for notice by either side would be enough.

**Temporary Nature of the Employment.**—One important point, often overlooked by employers, is the temporary nature of the employment. Moreover the Clerk of Works has either to move his residence with each engagement or take lodgings, either of which is a drawback upon his salary.

**Extent of Notice.**—A month is the minimum period of notice that should be given.

## SCHOOL BOARD FOR LONDON.

## ARCHITECTS' DEPARTMENT.

*Instructions to Clerks of Works.*

1. The Clerk of Works is responsible directly to the Architect for the due performance of the work entrusted to his superintendence in strict accordance with the Specification and Drawings, subject however to instruction 20.

2. On receiving his nomination to a School, he will be supplied with a Diary, a Specification, and a set of Working Drawings, the whole of which, together with all detail drawings, are the property of the Board, and must be returned to the Head Office, with a complete plan of the Drains as laid within one month after the completion of the Building.

3. The Clerk of Works is to be present at the setting out of the boundaries of the Site, and of the Building, and to see that the Site boundaries are properly given to the Contractor by the Board's Surveyor or his recognized representative.

4. He is also to see that a solid stump is permanently fixed in some convenient point on the site, from which as a datum all levels are

to be taken, and heights of floors and depths of foundations measured. This is a point requiring much care, and is to be finally approved by the Architect before the commencement of the Works.

5. On the commencement of the Works he is to thoroughly master the various points of the Specification and Drawings, and to ascertain precisely what is included in the Contract.

6. He is to make for his own use, in a Manuscript Book, a copy of all such parts of the Specification as relate to materials and general execution of the work; such copy to be written on one side of each page, leaving the other blank for making thereon, as the work proceeds, any notes that may be needed as to deviations that he may observe, putting a date to each. He is to take such steps as may be found necessary from time to time to test the quality of cement, ironwork, and other material delivered on the Site. He will see that the flooring boards, wood blocks, and such like materials are properly stacked on the Site as specified, at an early stage of the Works, so that the air can pass freely through and between same, to ensure thorough seasoning.

All fence walls uncovered by roofing, built between the 29th September and 25th March, to be carried up wholly in cement mortar.

7. Should the excavations prove that additional foundations are necessary, he is (so soon as the depth taken in the Contract has been reached) immediately to apprise the Architect of the fact in writing and await instructions. On the other hand, he is expected to use his judgment, and if he considers it unnecessary to go to the depth shown on the drawings, to notify the facts to the Architect and obtain instructions. He is also to prepare careful plans and sections of all the foundations, and to assist in the measurement of them before any filling in or further work is done. All such notes to be written in ink and deposited with the Architect as soon as the work is completed. So soon as the foundations are in and before they are covered up, he will immediately apprise the Architect so that the Measuring Surveyor can visit the work and ascertain precisely the amount of foundation executed.

8. He is to take especial care that no "live" drains of any kind on the Board's Site are cut off, diverted, or in any way interfered

with without proper instructions from the Architect.

9. He is to be careful to see that the Builders do not interfere with any boundary walls or party walls before the proper legal notices in respect thereto have been served, or have expired.

10. If any details or other information be required, he is to communicate at once with the Architect.

11. During the progress of the works he is to properly fill in and forward a weekly report on the form provided, which must be addressed to the Architect and reach the Head Office by 10 a.m. every Thursday. He will forward weekly with his Reports all day sheets certified by him for work done the previous week, in accordance with the Architect's Official order. In the event of delay by the Contractor in rendering such day sheets, he will inform the Architect in his following weekly report, and must enter in his diary day by day the time and material spent or ordered by the Architect to be executed day work, so that he will be enabled at any time to check the day sheets when rendered by the Contractor.



12. Such reports to be founded on the notes made day by day in the diary and to record the state of the weather each day, the visits of the Contractor or his assistants, and of the Architect or other persons interested in the progress of the work ; also a complete statement as to the number of men employed and the materials of each kind brought upon the premises. The entering up of the diaries is always to be done as the day passes, and it is to be borne in mind that full information, rather than fine writing is the thing to be desired.

13. In the case of an enlargement, he is to see that neither the Board's gas nor water is consumed by the Contractor without previous written authority from the Architect, unless so specified, and to take measures for ascertaining the exact quantity made use of.

14. He is to devote the whole of his time to the Board, and to reside within the Metropolitan area, and to be in attendance on the Works during the whole of the working hours, unless specially relieved from duty or summoned to the Office.

15. He is to see at an early stage of the Works, wherever existing levels have to be altered, the earth is filled in, so that it may be

consolidating during their whole progress with a view to being in fit condition to receive the substratum for the tar paving to be laid prior to the opening of the School.

16. The date for the completion of the Contract is to be stated on his copy of the Specification, and he will be expected to see that the works so proceed that they will be completed by such date. If such should appear to be unlikely, he is to notify the same to the Architect. He is to give the Architect, in writing, an approximate 3 months' notice of completion and a final month's notice certain.

17. On the completion of the Works he is to prepare and deposit at the Head Office a plan on tracing cloth, drawn to a scale of 8 feet to an inch, showing the drains and depth of same, and also the gas and water mains in distinct colours, and any variations in the buildings in detail.

18. The drain plan is also to show any drain connected with adjoining property, or parish, or other drains which may be upon the Board's Site.

19. He will deposit at the Head Office the Drawings, Specification, Diaries, and other documents belonging to the Board together with his own written copy of the Specification.

20. If during the progress of the work it should appear to him possible to effect any saving without detriment to the building, he will forward his suggestions to the Architect for consideration. No variation, however, must be made without the previous receipt of a formal official order from the Architect.

21. In the case of absence from illness, immediate intimation thereof to be forwarded to the Architect, and in the event of such illness extending beyond a period of two days a Doctor's Certificate will be necessary.

22. Finally, each Clerk of Works is to remember the responsibility of his position, and that upon his constant and intelligent care and vigilance must, to a large extent, depend the successful execution of the work entrusted to him, that he should make it his study in every possible way to help rather than to harass men in his efforts to get good work done by them; and while ready, sternly, to rebuke dishonesty or slovenliness, he should not be less ready to acknowledge with approbation the real desire on the part of any man to do his work thoroughly well.

## THE INCORPORATED CLERKS OF WORKS ASSOCIATION OF GREAT BRITAIN.

The Clerks of Works Association has adopted the principle of examination in a modified form and might carry it further to its advantage.

This Association has done good work and comprises a large proportion of the best men in the business. There is no doubt that the strengthening of this Society will powerfully contribute to increase the importance of the office of Clerk of Works and to help its practitioners.

The benefits derived from the complete unity of the members of a business or profession cannot be overrated, and with this view every Clerk of Works should belong to it.

The conditions of membership are as follows:

### MEMBERS.

“The following shall be eligible for membership, that is to say: persons who are fully qualified and *bonâ fide* Clerks of Works, and not being employed in any trade by any Builder

or Contractor, and having acted as Clerks of Works only, during the five previous years, or for seven consecutive years at some former period, and who are over forty years of age."

"Candidates over thirty-five and under forty years of age must have passed the Carpenters Company's Examination in building and sanitary construction and have gained their certificate."

#### ASSOCIATES.

"Any candidate who is over thirty years of age and who holds a certificate from the Carpenters Company in building and sanitary construction may be elected as an associate. . . . Such associate may attend all meetings but shall not vote upon any question or take any part in the government of the Association, neither shall he be eligible for any benefit until he is elected a member."

The following are specimen questions of the Carpenters Company's Examination.

*"No one under twenty years of age will be admitted to the Examination."*

1. State the various soils that are considered to be healthy or unhealthy to build upon.

2. When compelled to build upon an "unhealthy soil" state the best means to counteract the ill effects.
3. State the materials used in mortar, cement, lime concrete, and cement concrete, and the proportions in which they should be employed, and the mode of mixing, and the means by which a good hydraulic cement should be tested.
4. The basement of a house is damp. Enumerate the possible causes and suggest remedies.
5. What is the object of the damp proof course? Under what circumstances would it be useless? Give sketch showing how you would deal with the building under these circumstances.
6. Under what circumstances would you use hollow walls? State how they should be constructed, and give sketches showing ties and sections through head of window frame.
7. Describe with sketches and criticise a "Bell Trap," a "D Trap," a "Syphon Trap," and a "P Trap."
8. What materials are used for soil pipes, and which do you consider best? What faults



- are likely to be found in them? How should soil pipes be ventilated?
9. What are the objects of a water-trap? Describe good and bad forms of traps. What is meant by disconnection of waste pipes, and what are its objects?
  10. Describe some of the best forms of water closets in general use. What are the advantages and disadvantages of each? Illustrate your answer by sketches.
  11. In what circumstances can the use of earth closets be recommended? Are they suitable for large towns? State the reason for your opinion.
  12. Explain in detail and by sketches the way to lay a 6-inch stoneware house drain. What are the best methods in use for testing a house drain and connections thereto, both when first laid to prove soundness, and afterwards to ascertain position of defects.
  13. State the conditions that have to be complied with in the construction of a house drain and a sewer to ensure their being self-cleansing. What fall should be given to a 6-inch house drain?

14. In constructing a brick sewer enumerate the materials that should be used. Describe in detail the way to set out the work and the duties of the Clerk of Works in superintending its execution.
15. How can a church or chapel seating 500 people, without a gallery, be conveniently warmed? How much should the apparatus be able to raise the temperature of the atmosphere in it, and at what temperature should the interior of the building be kept?
16. What are the insanitary conditions commonly to be met with in a theatre or concert room, and what can you suggest should be done (*a*) to avoid their occurrence in a new building; (*b*) to remedy them in an existing one?
17. State the advantages of and the objections to cast iron pipes as used to carry house drainage under a dwelling-house.
18. Explain fire-resisting flooring, and give sketches showing construction. Name at least three different systems, and explain the advantages and disadvantages of each.
19. Give sketches, showing single, double, and

- double-framed wood floors, and explain the advantages and disadvantages of each.
20. State the various regulations in force within the County of London referring to the situation, ventilation, and construction of water closets, *or, as an alternative*, the regulations affecting the same to be found in the model Bye-laws.

*Note.*—In addition to the foregoing specimen questions, Candidates are informed that any questions may be set relating to Plastering, Carpentry and Joinery, Masonry, &c., the object being to test fully his knowledge in all branches of the Building Trades, as well as his acquaintance with the sanitation of buildings and the regulations in force.

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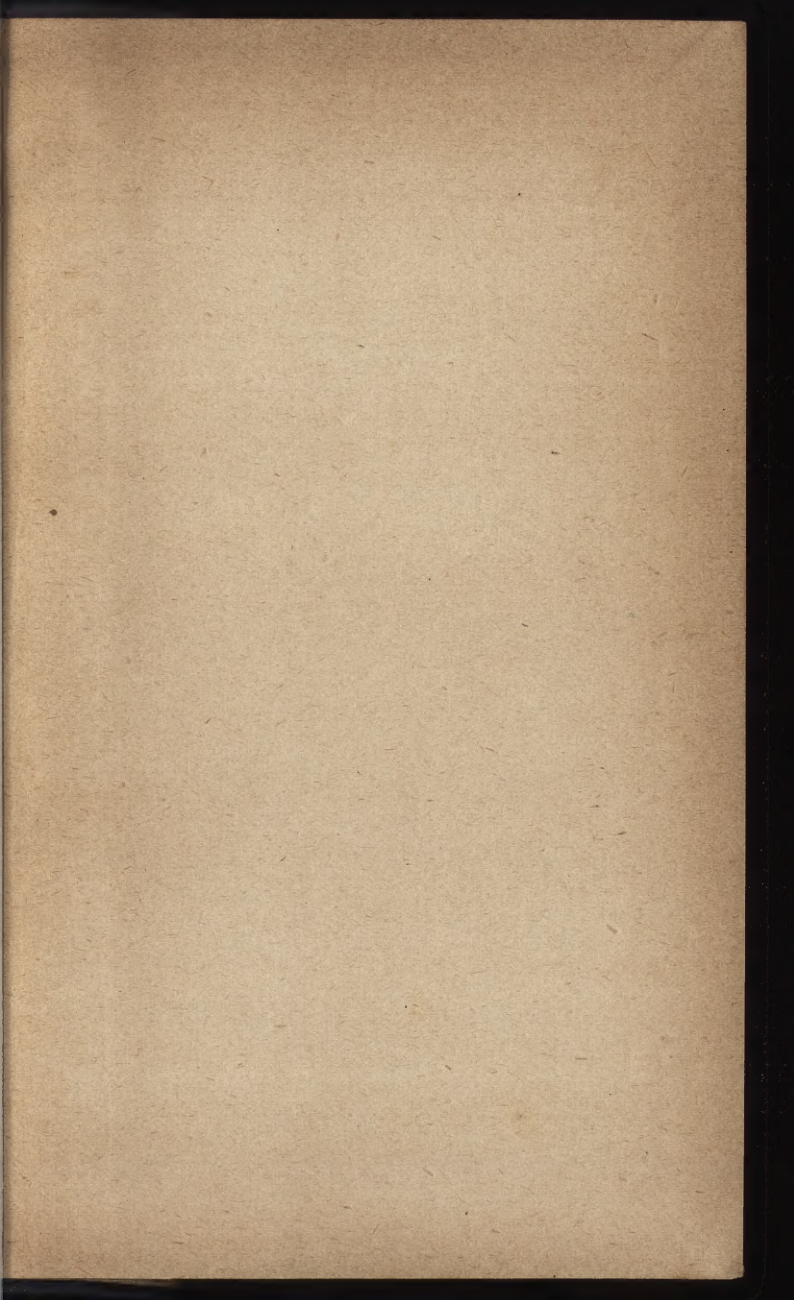
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